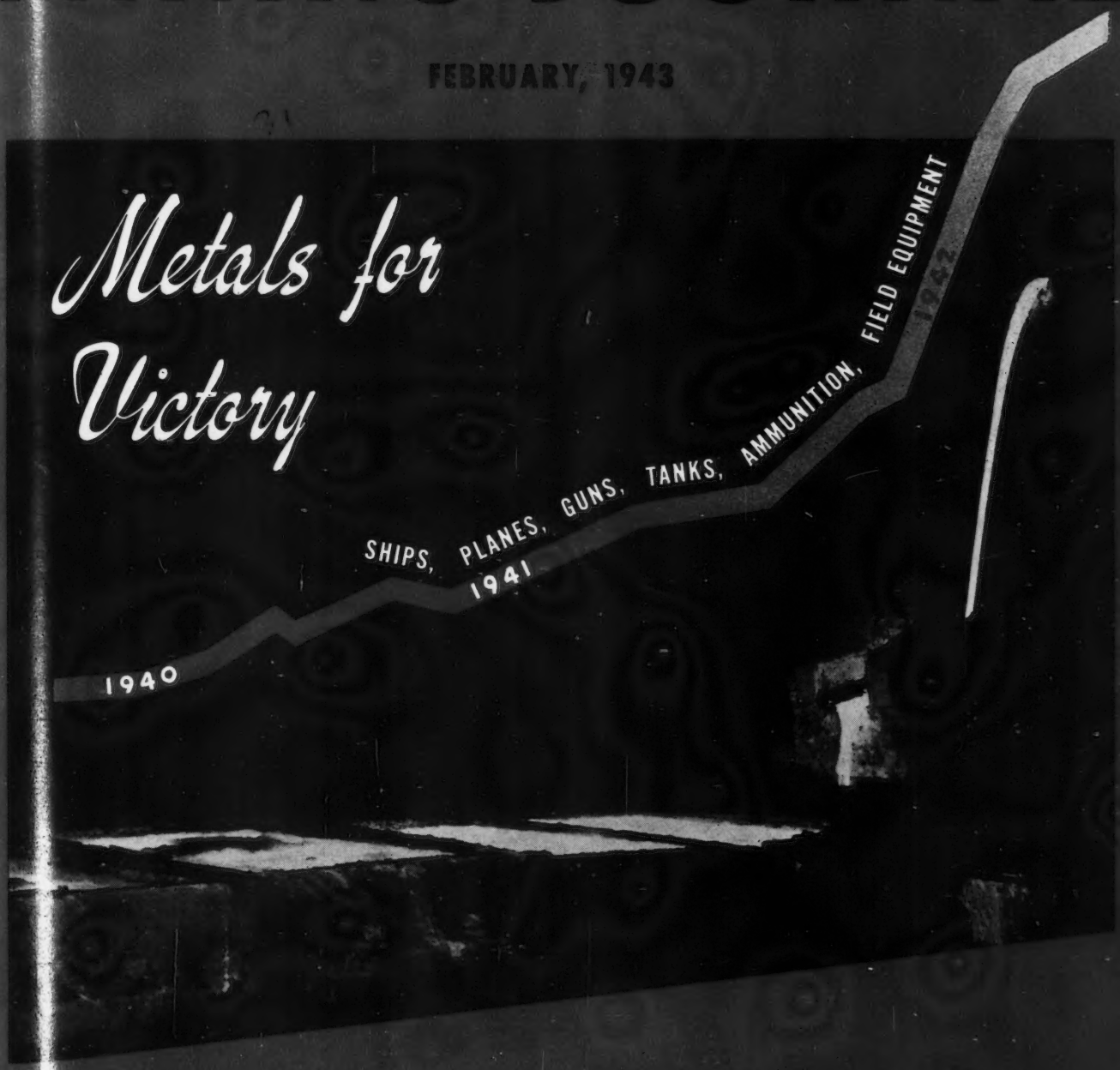
ENGINEERING AND MINING JOURNAL

FEBRUARY, 1943



The 74th SURVEY and OUTLOOK Number

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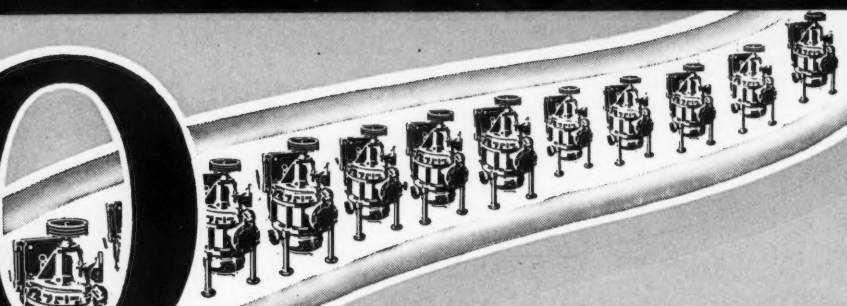
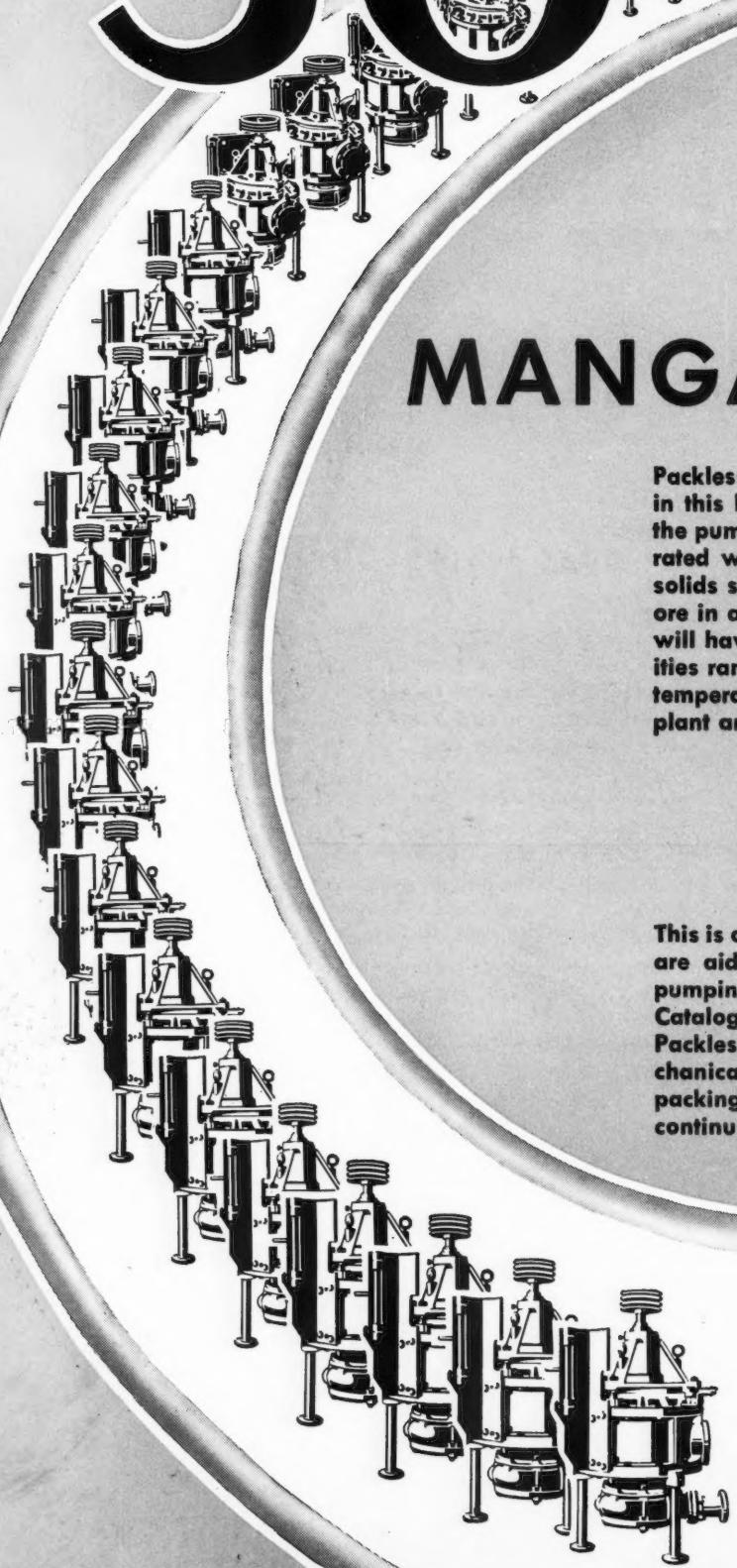
PRICE ONE DOLLAR

30



DRAFTED FOR WAR WORK *in a* MANGANESE PLANT



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" " "		Acid Wash
" " "		Wash Water
Mill Solution to Pulpers	handling	Acid Solution
Acid Liquor to Neutralizer	"	" "
Reactors to Clarifiers	"	Neutral Solution
Surge to First Reactor	"	Neutral Pulp
Pebble Mill to Surge	"	" "

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Infrared photography is responsible for the interesting view on the lower half of page 81 in this issue. The open pit shown is the Spruce mine of Oliver Iron Mining Co., now famous for its ore-transport system utilizing trucks and underground conveyors. Infrared light, having a longer wavelength, is absorbed to a smaller extent by haze than the portion of the spectrum visible to the human eye. Thus it produces a picture with characteristics out of the ordinary, yet a true one nevertheless. The photograph has been supplied by the Oliver company, United States Steel subsidiary.

▼

Other photos in this issue include the night view of Anaconda's reduction works in Montana, also on page 81. This was taken by C. Owen Smithers, of Butte. Also of unusual interest is the photograph in the lower right corner of page 93, supplied through the courtesy of J. A. Nelson's Studio, Johannesburg, South Africa. The camera that took it was looking up at the lowermost timber set in the shaft of West Vlakfontein gold mine, on the Witwatersrand, while sinking was in progress. On the front cover, incorporated in its design, the picture of the pouring of molten blister copper is credited to "Three Lions."

▼

At Butte, maintenance of equipment and salvage of scrap metals and other vital materials are being given especial attention at the Anaconda company's copper mines. Next month, S. Veazey, Jr., and H. M. Courtney, of the Engineering Research Department, will present ideas and suggestions that have been found to be practical in operation.

▼

Also, next month, a discussion of recent changes in mining and milling practice in the phosphate region of Central Tennessee.

A. M. STAEHLE
Publisher

ENGINEERING AND MINING JOURNAL

R. M. WARD
Manager

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H. C. PARMELEE
Editor

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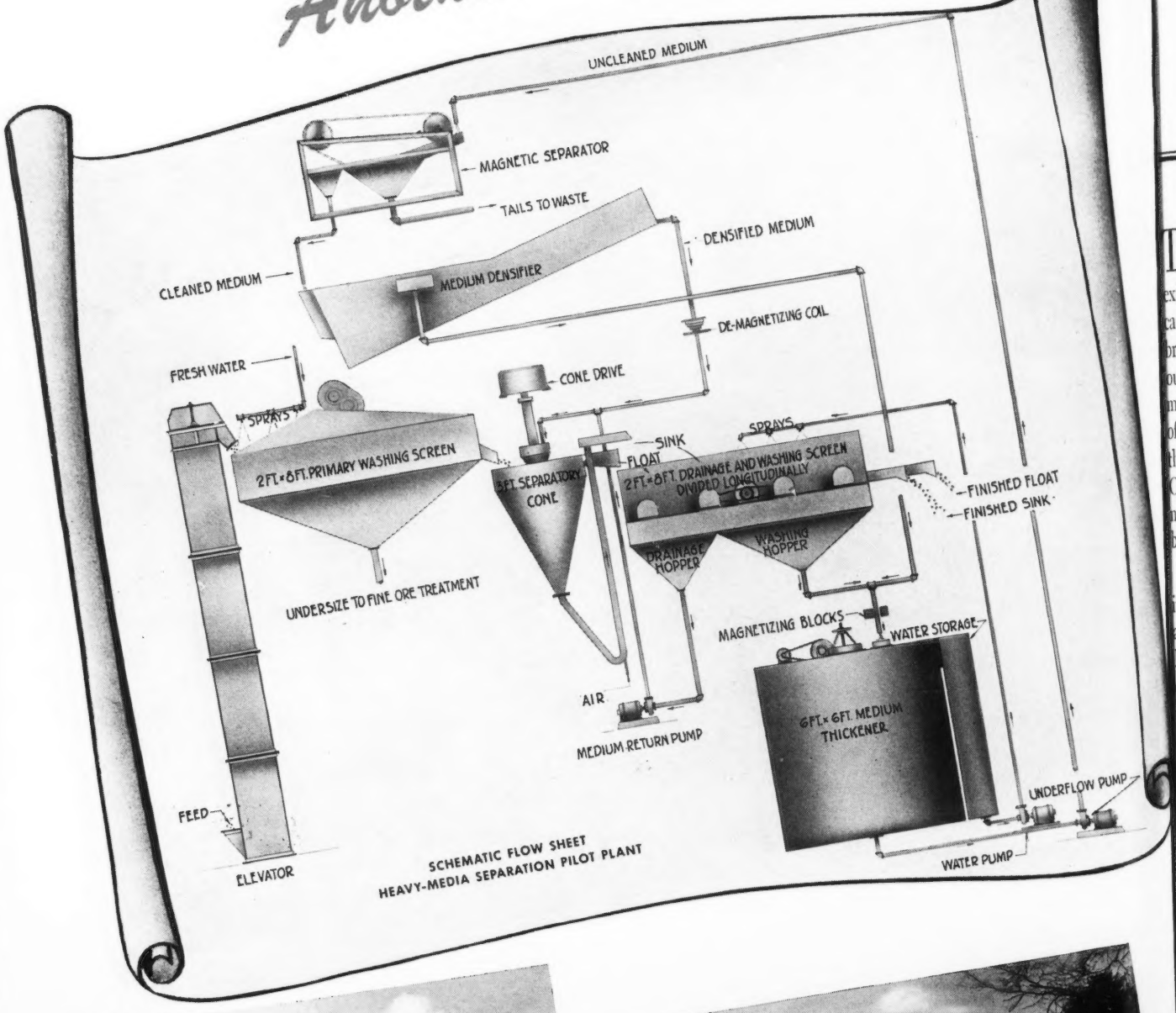

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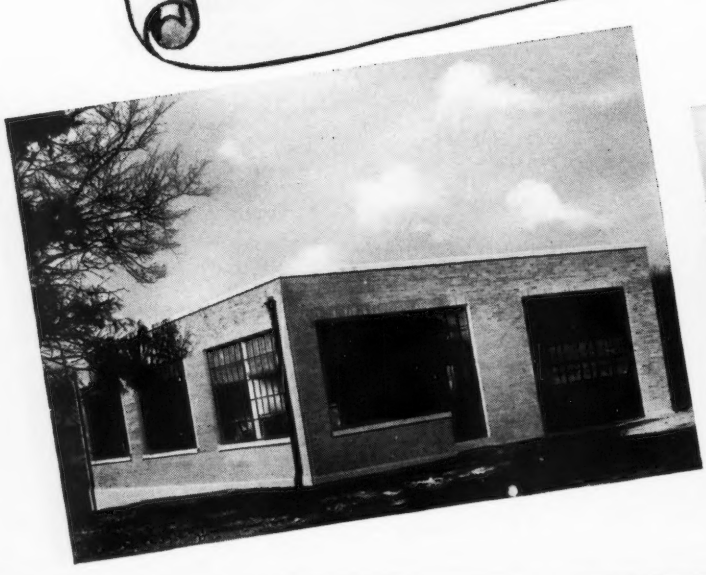

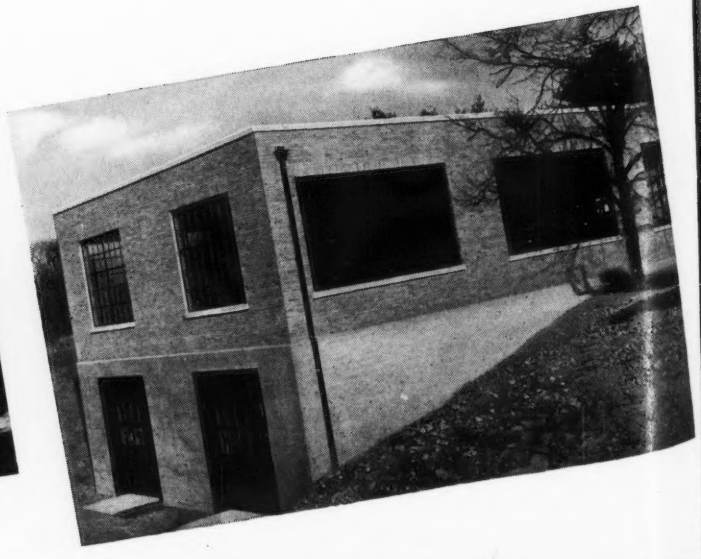

AMERICAN CYANAMID COMPANY

Mining—Number One War Industry

The mineral products of the earth are the prime necessities of war...and peace

THE SURFACE of the earth provided primitive man with the things he needed for his meager existence but civilization really began when he became curious about its interior. This curiosity has brought us a long way. For the earth has yielded—out of its deep recesses—all the raw materials of modern industry. And today, in the grueling race of production, our mining industry is providing the raw materials upon which depends our survival. Our mines and quarries must supply a long list of materials without which a successful war cannot be fought.

Take steel, for example. War without steel is inconceivable. Steel starts with iron ore, limestone and coke. These are products of mines and quarries. It takes power and heat to get these materials out of the ground, to refine them and to transport them to the point where processing begins. All the subsequent operations culminating in the steel ingot, shape or plate, and in moving the final product to the point of use require power and heat.

The major source of this power and heat is coal.

Production of a ton of steel, it has been stated, requires two tons of coal. Smelting of the pig iron alone, 60,000,000 tons in 1942, required the coking of some 75,000,000 tons of coal. Pig output is expected to rise to 68,000,000-70,000,000 tons in 1943, carrying coal consumption up to 85,000,000 tons. At the same time, output of steel ingots is expected to rise from 87,000,000 to 97,000,000 tons. Think what this means in terms of power and heat.

Another vital metal is copper. Modern armies need copper. This point is dramatically illustrated in a recent memorandum by Robert P. Patterson, Under Secretary of War, in announcing the release of 4,000 men from military service to return to the mines and increase copper production. "In a single minute of combat", Mr. Patterson declared, "a flight of 50 fighter planes shoots away 7 tons of copper. A 37-mm. anti-aircraft gun uses up a ton of copper every twenty minutes it is in operation. Six hundred pounds of copper go into every medium tank, and a ton into the engines and airframe of a Flying Fortress. The Signal Corps alone needs 5,000 tons of copper every month for radio and telegraphic and telephonic equipment. An army without copper would be an army without speed, maneuverability or firepower. It would not last a day in battle".

Seven tons of copper for one minute of combat by 50 fighter planes means from 200 to 700 tons of ore, depending upon its grade. Small wonder that the War Department was willing to release drafted miners from military duties to produce more copper.

But other metals are equally important in war: tungsten, nickel, manganese, chromium, vanadium and molybdenum for alloy steels; zinc for brass and die castings; tin for bronze and bearings; aluminum and magnesium for aircraft; lead and mercury for ammunition; silver for electrical equipment, bearings and solder, and so on. Even relatively insignificant non-metallics, like mica and diamonds, suddenly assume critical importance.

And let us not lose sight of the fact that without adequate energy, i.e., heat and power, production, processing, transportation and the relative comforts to which we have become accustomed would be impossible under war conditions. Coal is the major source of energy in the United States. It supplies more than half the total in normal years.

The railroads of the country alone used 110,000,000 tons in 1942 to move freight and passengers and service their facilities. Utilities consumed over 68,000,000 tons in the production of electric power. Over 135,000,000 tons of coal were consumed last year in maintaining the level of heating comfort necessary for the maintenance of efficiency and morale. The consumption, this year, will be even greater.

In short, the mineral products of the earth are the prime necessities of war.

The nations that control the world's mineral resources and make the most efficient use of them will win the victory.

Before the war, the British Empire and the United States together controlled probably 75 per cent of the world's mineral production. This would have been a most potent weapon in the United Nations' arsenal if the whole strategy of Axis expansion had not been influenced by mineral objectives. Addressing the American Zinc Institute on the subject last April, E. W. Pehrson, of the U. S. Bureau of Mines, estimated that the Axis had improved its position in world mineral resources in the following percentages: iron ore, from 6 to 46; steel production capacity, 20 to 34; petroleum, 1 to 7; coal, 27 to 53; copper, 5 to 10; lead, 7 to 22; zinc, 16 to 27; tin, 1 to 72; manganese, 2 to 30; chrome, 3 to 30; tungsten, 6 to 60. In the light metals, areas now Axis-controlled produced in 1940 54 per cent of the world's aluminum, 49 per cent of the bauxite (the principal source of aluminum) and two-thirds of the magnesium.

This is the eighth of a series of editorials appearing monthly in all McGraw-Hill publications, reaching more than one and one-half million readers, and in daily newspapers in New York, Chicago and Washington, D. C. They are dedicated to the purpose of telling the part that each industry is playing in the war effort and of informing the public on the magnificent war-production accomplishments of America's industries.

Despite these gains, the industrial war power of the United Nations still can outweigh that of the Axis by a considerable margin. It already has begun to surpass it. The problem is to convert quickly our potential mineral resources into implements of war. In this conversion, a heavy burden of responsibility has been placed on the mining industry of the United States as the largest producer of many metals, minerals and fuels. In fact, the United States mining industry began to go on a war basis a year before Pearl Harbor. The curves of demand for domestic copper, lead, zinc and other metals began to rise sharply in 1940, and were paralleled by a rising coal production.

How well the job has been done cannot be revealed in accurate figures in many cases because of censorship. In metals, however, some idea of production gains can be indicated in comparative terms. United States copper production, for example, is breaking all previous records. Aluminum capacity will be more than seven times its annual peace-time average. Magnesium plants now building will have a capacity 100 times the largest yearly before-the-war figure. Molybdenum, of which the United States has the largest single mine in the world, is being made available in record quantity. Zinc, lead and mercury are surpassing expectations in meeting wartime demands, and tungsten, chromium, manganese, antimony and iron and steel are being turned out in record-breaking quantities.

Bituminous coal production in 1942 was 580,000,000 tons, the greatest in history, valued at more than $1,300,000,000 at the mine. Some 430,000 or more men were employed in 1942 and received at least $750,000,000 in wages. Bituminous production in 1939 was 394,855,000 tons, while the output for 1943 is forecast at approximately 600,000,000 tons — another new United States record. The 1942 anthracite output was 59,961,000 tons, valued at over $270,000,000 at the mine. The industry employed some 85,000 men and paid out at least $180,000,000 in wages. The 1939 production of anthracite was 51,487,000 tons, and the forecast for 1943 is 65,000,000 tons or more.

Marshalling the Western Hemisphere's mineral resources, the United Nations have been the beneficiaries of the diversified resources of two continents — in particular of Canada's nickel and coal, Mexico's lead and antimony, Chile's copper, Bolivia's tin, Peru's vanadium, Brazil's iron, and Venezuela's petroleum. With other United Nations contributing their share of metals and fuel, the grand total is an impressive array of potential munitions and matériel to lend assurance of certain victory over the Axis. Sheer weight of metal, properly used, will win the war, and our mineral industry will have played an indispensable and essential part in the inevitable outcome.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Company, Inc.

ENGINEERING AND MINING JOURNAL

H. C. PARMELEE, Editor

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VOLUME 144 FEBRUARY 1943 NUMBER 2

1942 ★ REVIEW AND OUTLOOK ★ 1943

As War Production Mounts

Censorship has interposed an insuperable obstacle between the editors of *Engineering and Mining Journal* and an adequate survey of the mining industry in 1942. Facts and figures that would give aid and comfort to the enemy must not be disclosed, and a vast fund of significant information must be suppressed. Nevertheless, the contributors to this issue have contrived to give a fair picture of the mining industry's vital part in the national war effort. If the reader finds the result incomplete or disappointing, he is assured that the editors have made the best of a difficult situation in which they have tried to comply wholeheartedly with the restrictions of the Office of Censorship.

In its first full year of participation in the war the United States produced in 1942 a larger tonnage of metals and minerals than in any like period in its history. Their value rose to more than seven and one-half billion dollars, likewise an all-time record, with only a moderate rise in prices. Nevertheless, production lagged behind demand, and probably will continue to do so in 1943 despite further increases in output. The needs of the war program are almost insatiable.

The magnitude of the national effort in expanded mineral production and new metallurgical plant construction is indicated in the activities of Metals Reserve Company and Defense Plant Corporation. Buying at home and abroad since its creation in June, 1940, Metals Reserve has made commitments aggregating three and one-quarter billion dollars, forty percent of which was in the foreign field. Agreements were made with Governments of foreign countries as well as with foreign corporations. Defense Plant's activities were almost as spectacular, its commitments for new construction or expansion in the metallurgical field amounting to more than two billion dollars. Ninety percent of the money was for war plants for iron and steel, aluminum and magnesium. The remainder was allocated to a dozen or more items of critical importance.

As in 1941, the light metals, those of the ferro-alloy group, and some of the critical non-ferrous metals, like tin, held the spotlight in 1942. "Tight" situations in supply were eased in most instances as the year advanced, and on the whole the war production program was not seriously impeded by lack of raw metal. Of the precious metals, gold was a war casualty, without compensating gain to the war effort, and suffered a decrease in production of more than one-third. Silver likewise showed a decline of about one-fifth, but its essentiality in the war production program was such as to create the largest industrial demand the metal has ever enjoyed.

Shortage of manpower was probably the industry's biggest "headache" in 1942, with inadequate metal prices assuming increasing importance as the passing months witnessed rising costs of labor and materials. Neither problem was satisfactorily solved before the year expired, and both must receive further attention if mine development and production are to measure up to war needs. Men, money, and machines must be supplied if maximum production is to be obtained.

Looking to the future, the industry can have but one objective for 1943—metal and mineral production to the limit of its resources, even though that involves hardship and sacrifice. But beyond that, and without relaxing their concentration on winning the war, leaders in the industry are beginning to give thought to post-war political and economic policies that will vitally affect the welfare of the entire country as well as of the industry itself.

COPPER

Supply continues inadequate despite record tonnages available and sharp reduction in civilian consumption. World output established all-time high

H. H. Wanders *Market Editor*

DESPITE SHARP WAR-TIME CONTRACTION in consumption of copper for non-military uses, and notwithstanding that more of the metal was available in this country than ever before, the cry for larger tonnages continued throughout 1942. World production of new copper in 1942 probably amounted to 2,900,000 tons (details not available owing to censorship), which compares with a conjectural total of 2,700,000 tons for 1941 and 2,184,000 tons in 1938, the year before the second World War started. The United Nations during the last year had access to approximately 87.5 percent of the world's production of new copper, plus substantial tonnages recovered from scrap and "frozen" inventories.

The chief of the Copper Division of the War Production Board, H. O. King, in a statement released for publication last October, estimated total United States copper supply for 1942 at 2,571,700 tons, which compares with 2,467,100 tons in 1941 and 1,913,800 tons in 1940. These total supply figures embrace domestically produced copper, imported copper, and metal salvaged from scrap and other sources. Mr. King declared that every pound of copper available has been going into direct military orders, shipments to our allies, or into essential industrial uses bearing high preference ratings. Later he declared that "the supply of copper is not adequate and never will be while this war is on."

As in the preceding year, copper authorities found it difficult to translate the huge demand for copper into actual war requirements, and the feeling persisted in some directions that perhaps loose estimating entered into the tremendous tonnages asked for to feed the war machine. However, production of munitions during the last year proved to be exceedingly large. President Roosevelt, in his January, 1943, message to Congress, revealed that the United States produced 10,250,000,000 rounds of small-arms ammunition during 1942, a figure five times greater than our 1941 production and three times greater than our total production in the first World War. Production of artillery ammunition was 181,000,000 rounds; twelve times greater than in 1941 and ten times greater than our total production in the first World War. The President's figures on production of ships, planes, tanks, and other war equipment were equally impressive, and, if a statistician could break down the production figures into copper required to do the job, the answer to where all of the copper has been going might become less of a mystery.

That distribution of copper under the allocations system was far from perfect was generally admitted by all who gave the matter serious study. Consequently, when on Nov. 2 the War Production Board announced an improved plan for the control of critical materials gradually to replace the Production Requirements Plan, which, in turn, grew out of the old Defense Supplies Rating Plan, no one was surprised. The "CMP" plan was devised to make certain that future production schedules in manufactured products are adjusted to conform with the available supply of the critical materials. Copper, aluminum, and alloy steel were selected to be the first metals to be brought under the new plan that is to become fully effective at the beginning of the second quarter of 1943. Commenting on the outlook for civilian supplies of copper, Leon Henderson, Price Administrator and also head of the Office of Civilian Supply, said his requests for civilian needs in 1943 "will be less than three-quarters of 1 percent of the available supply." A Requirements Committee will have final say on distribution of copper.

The formal ceiling price of 12c. a pound, Connecticut Valley, set by the Office of Price Administration in August, 1941, was continued on all domestic transactions with consumers during the last year. Copper acquired by Metals Reserve Co. under special terms was sold to domestic consumers on the 12c. basis so as not to disturb the general price structure.

Imports of foreign origin copper were the largest on record, with the flow of the metal to this country stimulated as a result of a more liberal price policy accorded foreign producers, particularly those operating in the Western Hemisphere. The *E.&M.J.* average price of foreign copper for 1942 was 11.684c. a pound, f.o.b. refinery, against an average of 10.901c. in 1941 and 10.770c. in 1940. Higher operating costs and increased taxation were cited by producers situated outside of this country and operating in a restricted economy, because of the war, as justification for higher prices.

A problem that confronted the domestic copper industry was to lift production without in any way disturbing the 12c. ceiling imposed by OPA. A premium payment plan on over-quota production was devised by the price division of the War Production Board, which was subsequently adopted and developed by WPB, OPA, and Metals Reserve Co. The plan was looked upon in industry circles as a rather cumbersome method of stimulating production of so vital a war material as copper. Large producers received little or no assistance under the plan, and smaller producers who benefited under the arrangement were not in a position to produce copper on a scale greatly to influence the production curve. The premium established for copper under the plan was 5c. a pound, a substantial margin above the 12c. basis if quotas had been set sufficiently low for all concerned to offset rising costs and other expenses incurred in developing additional output.

So far as new production was concerned, the outstanding development of the year was the completion of the Morenci property of Phelps Dodge, in

World's Production of Copper

Production of copper for the world for ten years beginning with 1933 is shown in the following table. The figures cover blister output derived from ore, usually referred to as new copper. Annual totals for the years 1933 to 1939, inclusive, were compiled by the American Bureau of Metal Statistics; those for 1940, 1941, and 1942 are *E.&M.J.* estimates.

(In Short Tons)

1933	1,146,260
1934	1,401,334
1935	1,617,032
1936	1,848,521
1937	2,498,693
1938	2,187,037
1939	2,385,365
1940	2,625,000
1941	2,700,000
1942	2,900,000

Arizona. The concentrator started operating on Jan. 30, 1942, and metal from the open-pit mine reached the market place in June. Both fire-refined and electrolytic copper were produced from metal recovered at the property. The original plan for bringing in Morenci called for a capacity of 75,000 tons of copper a year, all financed by the corporation. During 1942, however, the Defense Plant Corp. agreed to finance an extension to the plant that is to raise output by about 60,000 tons.

More than 100,000 tons of additional production over the 1942 rate is scheduled for this country for the current year, a large proportion coming out of Arizona. A record tonnage of copper was produced last year in Latin American countries and peak production in Chile, Peru, and Mexico is expected to be maintained throughout 1943. Shipping facilities for the importation of copper will be provided at any cost, just as in the preceding year.

Though domestic production of copper during 1942 was the largest on record (figures not available for publication), output would have been even greater except for a labor shortage that was not alleviated until after the situation was given a thorough airing before the proper authorities in Washington. Production during the months of July and August would have been 5,000 tons a month larger in volume had it not been for a manpower shortage caused by the induction of miners into the armed forces and migration of labor for more lucrative work at defense projects and shipyards. Before the end of the year it was stated officially that 4,000 soldiers with mining experience had been furloughed to work in the mines.

Censorship prevented news on developments in the important copper-producing districts of Africa and Canada from coming out into the open. Reports to stockholders revealed that output in Northern Rhodesia and the Belgian Congo held to a satisfactory level. In Canada production increased last year, due in part to an expansion program by International Nickel. Prices paid for copper produced in countries supplying the United Kingdom remained unchanged.

The war program for 1943 calls for more copper than ever. Other materials will be used more extensively as a substitute for the "critical" metal. But an idea of what the situation calls for may be gleaned from the War Production Board's statement made at the turn of the year which declared that 700,000 tons of copper from all sources (primary, scrap, and inventory metal) will be available for distribution in this country and for Lend-Lease requirements during the first quarter of 1943.

ZINC

Despite unprecedented demands, industry has been able to meet essential requirements, and is well equipped to go forward, given adequate concentrate supplies

Evan Just *Assistant Editor*

ALTHOUGH the country had pushed its zinc productive capacity up to double that of ordinary times, the insatiable appetite of the "arsenal of democracy" continued to make such demands on the zinc supply in 1942 that tighter and tighter restrictions were placed upon its use. The reason for this situation was evident when the President, in his message to the seventy-eighth Congress early in January, released the fantastic totals achieved in ammunition production and in the production of other war matériel. In an earlier statement, the President also revealed that over 16 percent of domestic slab zinc output was being exported to our allies, through Lend-Lease and direct purchases. Had these demands been made without the restrictions thrown around prices and uses, it is certain that the price would have risen to at least double that which prevailed throughout the year, namely 8.25c. per pound, St. Louis, on Prime Western.

Notwithstanding announcements that substantial portions of the shell cases for large-caliber ammunition were being made of steel instead of brass, military requirements for brass continued to mount as rapidly as the expanding brass-mill capacity would permit. Brass replaced galvanizing as the primary use of zinc, partly by virtue of this increase and partly because of a drastic decline in galvanizing operations, which were reported late in the year as reduced to 40 percent of the rate of a year previously. This level of galvanizing operations was regarded by one authority[1] as close to the irreducible minimum.

The need for cartridge brass created a convergence of demand upon higher grades of zinc, of which the shortage was particularly acute, while the relaxation of galvanizing permitted a relatively easy situation in Prime Western metal. Some of this unbalance was adjusted by an expansion of vertical-retort redistillation facilities, and some by refinements of horizontal-retort reduction practices. It is anticipated that new electrolytic and vertical-retort capacity will be sufficient to provide full flexibility by mid-1943, so that the pressure on various grades will be equalized.

Principally because of the curtailment of tire manufacturing, the consumption of zinc oxide was somewhat reduced, and put no strain on production capacity. The expected rise in rubber output in 1943 will probably increase the need for oxide, but it is not anticipated that essential requirements cannot be met. French process oxide production was reduced because of the effect on metal output. Zinc dust output lagged somewhat early in the year, but military requirements boosted production to capacity in the later months. The extent to which zinc die castings were used in armament production remained a military secret.

Publication of monthly figures of slab zinc production since midsummer and of annual output is censored by the ordinary sources of this information. A statement which appeared in

World's Zinc Production

Production of zinc by metallurgical plants of the world whose principal business is the reduction of ore, according to the "Yearbook" of the American Bureau of Metal Statistics. Excluded from the accounting is metal produced by redistillers who treat old material.

(In Short Tons)

1933	1,106,864
1934	1,305,052
1935	1,487,088
1936	1,641,634
1937	1,838,487
1938	1,752,330
1939	1,850,704
1940	*(a)*
1941	*(a)*
1942	*(a)*

(a) Not available.

[1] Gent, E. V.: "A Review of the Zinc Industry in 1942." American Zinc Institute, New York, N. Y.

trade papers in early January, attributed to Lieutenant Commander W. H. Spowers, Jr., of the U. S. Navy Bureau of Ships, gave a 1942 production rate substantially less than was anticipated some months ago.[2] However, the indicated loss is merely a delay, and it is now believed that production capacity substantially in excess of that planned a year ago will be in operation by the second quarter of 1943.

At the beginning of 1942 General Preference Order M-11 was in effect and remained so until May 31. This order gave the War Production Board such control over zinc supplies as it saw fit and left the distribution of the remainder in the hands of the industry. The percentage of previous month's production mandated by WPB under this order increased from 31 in January to 75 of high grade and 50 of other grades in May. The execution of this order was so efficient and satisfactory in comparison to the allocation of other metals which had been taken under complete government mandate that comparisons became somewhat embarrassing to apologists for bureaucracy, and many observers wondered why it was deemed necessary to resort to complete government allocation. Order M-11 was amended May 11 to require allocation certificates for all shipments.

The first restrictions on the use of zinc, except as effected by control over distribution, were made July 24 with the issuance of Conservation Order M-11-b. Under this order, which exempted applications particularly identified with the war program, uses defined on "List A" were cut to 50 percent until Sept. 1, and then discontinued entirely. List A[3] included several applications of die casting, ornamental parts for automobiles, many hardware items, caskets, kitchen utensils, art objects, vacuum cleaners, and washing machines. In other items the use of zinc was cut 25 percent for Prime Western and 50 percent for higher grades.

The use of rolled zinc for jar tops was forbidden after Oct. 10, by an amendment to the order. Another amendment, effective Nov. 30, made further additions to the prohibited List A.

Further amendments were also issued limiting the use of zinc in printing and in dry battery cups.

Zinc oxide and zinc dust had been under General Preference Order M-11-a, which involved the same system that M-11 applied to slab zinc. However, since May no mandates have been issued with respect to zinc oxide because of the plentiful supply. On Dec. 22 zinc dust was removed from this order and put under allocation.

So far, although zinc has been "tight," capacity has been sufficient to prevent its operating as a primary bottleneck on fabrication capacities essential to the war economy. With the new reduction capacity expected to be in operation by mid-year, it is hoped that this situation will not be altered, except for the better. At any rate, with further application of substitutions and with increased contributions of scrap from the battlefields, there seems to be little reason to expect that lack of zinc will jeopardize the war effort, if adequate steps are taken to afford concentrate supplies to feed the reduction capacity. With all the new reduction plant construction near completion, and allocation settled down to a routine, the principal zinc problem before the War Production Board is that of forestalling concentrate deficiencies.

Throughout the year 1941 it had been evident that the shortage of ships would make it unsafe to depend on water-borne shipments for concentrate supplies, and that prevailing prices would not permit a safe level of domestic mine production. After nearly a year of deliberation, the Office of Price Administration decided on a premium-quota plan, effective Feb. 1, 1942, for a period of 2½ years as an alternative to permitting a rise in price or a flat subsidy for concentrate production. This plan undertook to have Metals Reserve Co. pay premiums to producers of ore and concentrates for production in excess of quotas arbitrarily established, but based usually on the average rate of production made during the previous year. Premiums amounted to 5c. per pound for the recoverable copper content, 2¾c. for lead, and 2¾c. for zinc, based on smelter settlements and paid by smelters as agents of Metals Reserve. In the Tri-State district a flat premium was established on sulphide concentrates of $28.05 per concentrate ton for zinc and $39.60 for lead. This in effect presumed a 60 percent zinc content and an 85 percent recovery on all zinc concentrates. Late in the year, to expedite payments, settlements were based on presumed rather than actual recoveries, that presumed for zinc being 90 percent. The Tri-State zinc subsidy was raised concurrently to $29.70 per ton. The cost of the subsidies was borne by Metals Reserve and did not affect the prices paid by smelters and consumers.

In the early months of its history, the plan was more or less ineffective because the initial quotas were too high to afford significant increases in income to producers of the bulk of domestic output. Gradually, after interminable wrangling, quotas were gradually adjusted to more effective levels, and by the end of the year virtually all zinc production was on a near-zero quota basis which afforded premiums on substantially all output, and was in effect a flat subsidy to all concentrate production.

Outside of the difficulties and delays imposed by hair-splitting theorists, the premium-quota plan failed to beget an actual increase in production, simply because an 11c. price equivalent was insufficient to finance the development and mining of low enough grades of ore to meet the situation, particularly in view of the wage increases that took place during the year. Unquestionably, however, the application of the plan did forestall a decline which otherwise might have been serious. Taking 1942 as a whole, mines shipping to domestic smelters were able, despite rising costs and labor shortages, to furnish a supply equivalent to smelters' needs.

Looking toward the future, it is evident that so long as water-borne shipments cannot be depended upon, precautions must be taken to sustain approximately the present share of domestic production from the Tri-State district and to provoke development of low-grade ore reserves wherever possible. Up to date the production gains creditable to the premium-quota plan have been essentially from developed reserves. In early January, 1943, realization of the necessity of developing new ore reserves led to the amendment of the plan to authorize extension of premiums to as high as 8¼c. per pound for zinc and 5½c. for lead to those producers who could convince the WPB-OPA quota committee of the rectitude of their claims. The life of the guarantee period was also extended one year.

Monthly statistics prior to censorship are shown in the above table.

United States Zinc Statistics January-May, 1942

	Total Production	*Stock at End*	*Prime Western*	*Shipments*
January	79,213	23,862	30,396	79,413
February	73,476	22,626	26,616	74,775
March	79,139	21,702	29,494	80,063
April	77,034	22,559	29,059	76,177
May	79,489	18,447	29,493	83,601

[2] See *E.&M.J.* Feb. 1942, p. 44.
[3] See *E.&M.J.* Metal and Mineral Markets, July 30, 1942.

LEAD

Steady rate of domestic production, despite higher costs and increased receipts of foreign metal, eases supply outlook. Large stockpile on hand

F. E. Wormser *Secretary, Lead Industries Association*

A YEAR AGO there was apprehension in government circles over the adequacy of the lead supply for war needs. Lead was being consumed at a rate greater than domestic production could fill. Since then, however, the situation has been completely reversed, owing largely to governmental restrictions on some uses and to heavy importations from Mexico, Canada, Australia, and Peru. These imports were made by the government through the WPB, acting through Metals Reserve Co. Today the government possesses a stockpile large enough to place the metal in a comfortable position.

The federal government is now in the lead business in more ways than one, and its proprietary interest in a large stockpile may create new problems after the war, but right now the plentiful supply provides an opportunity to use lead to relieve, in some measure, the burden being thrown on copper and zinc (which have a more direct military application than lead), and on tin, aluminum, chromium, cadmium, nickel, mercury, and steel.

The growing availability of lead was not widely appreciated until a few months ago—even in some government agencies controlling construction. Now one can see signs of the metal being used in many directions. It is conceivable that some of the applications which are currently being developed so as to save other materials may prove permanent.

Domestic mine output for 1942 is estimated to be about the same as in 1941. Although some increase was hoped for, there were good reasons why it did not materialize. For one thing, mining companies in the West had to cope with unusually trying conditions. "Pirating" of labor and competition of highly paid, emergency shipyard military construction and armament plants caused a serious shortage in mines and smelters, which was finally met, in September, by "freezing" mine labor in the Rocky Mountain states, by increasing labor rates to the highest scale in history, and by releasing miners from the Army to return to the mines. Costs have risen. Obviously, to maintain full production, some means of compensating the operators had to be devised by the government.

The method used was to give each mining company a certain lead production quota (not necessarily the same percent for each property), with the proviso that any output above it was to be paid a premium price for a two-year period. A two-price system was thus established, designed to prevent an inflationary movement in nonferrous metal prices and yet stimulate output. New properties were given the full premium price, which for lead was 9¼c. per pound, New York, compared with the base price of 6½c. established by the OPA on Jan. 15, 1942 (which, up to then, had been 5.85c., New York). Some of the larger low-cost operators received quotas so high they could not hope to receive any premium payments.

Mining cost is still rising and development work, always important, is not being advanced in the West as rapidly as it should, to maintain full production. The problem of the producer, particularly the one of moderate size, has not been completely solved. Unless an answer is found soon, production may decline in the West in 1943.

Lead was under government control throughout 1942 under WPB's Order M-38, issued in January. The order originally established a pooling arrangement whereby each primary producer was ordered to set aside a small percentage (15 percent) of his current production to form a pool from which WPB's lead branch could meet consumers' emergency requirements. So easy, however, did the lead situation subsequently become, this "bank" became no longer necessary and the order was amended in August.

Receipts of lead from old battery plates and other sources of scrap kept up well in 1942. At the year end a sizable quantity of antimonial lead derived from scrap was seeking a market, but it is not felt that this will pose much of a problem.

On Dec. 23, the government announced the consummation of a trade agreement with Mexico cutting lead rates in the Tariff Act of 1930 by 50 percent. Thirty days after the termination of the emergency the reduction is to become 20 percent. The following shows the relationship of these rates:

Paragraph 391. Lead-bearing ores, flue dust, and mattes of all kinds, on the lead contained therein, 1½c. per lb. under Tariff Act of 1930; ¾c. per lb. under Mexican Agreement during the war; 1⅛c. per lb. under Mexican Agreement after the war.

Paragraph 392. Lead bullion or base bullion, lead in pigs and bars, lead dross, reclaimed lead, scrap lead, antimonial lead, antimonial scrap lead, type metal, babbitt metal, solder, all alloys or combinations of lead not specially provided for, on the lead contained therein, 2⅛c. per lb. under Tariff Act of 1930; 1 7/16c. per lb. under Mexican agreement during war; 1 7/16c. per lb. under Mexican agreement after war.

During the war the effect of this action, which gives the same reduction to other nations under the most-favored-nation policy, is purely academic, as the government is doing all the importing. But it has serious implications for the future of the country's lead industry.

To summarize, domestic lead production has not been large enough to satisfy domestic demand completely, so imports from Mexico, Canada, Australia and elsewhere have been used, moderately, to supplement domestic supply.

All in all, the lead position at the end of 1942 was one that should please those who have military considerations uppermost.

World's Production of Lead

Production of lead for the world in terms of smelter output, inclusive of a small percentage of secondary metal, according to figures compiled by the American Bureau of Metal Statistics. Owing to war conditions, no attempt is made to estimate production since 1940.

(In short tons)

1933	1,322,273
1934	1,493,391
1935	1,567,616
1936	1,641,335
1937	1,895,491
1938	1,878,529
1939	1,898,868
1940	(a)
1941	(a)
1942	(a)

(a) Not available.

TIN

Firm hold on its distribution results in comfortable supply outlook under war conditions. Smelter enlarged

H. H. Wanders
Market Editor

ESSENTIAL NEEDS for tin were provided during 1942 and plans for a continuing supply were perfected because those in control of the industry adhered strictly to four lines of approach to meet the problem. Stated briefly, the program called for (1) sharply curtailed consumption of tin in non-essential uses; (2) the importation of tin concentrate in quantity; (3) increase in capacity of the smelter in Texas; and (4) salvage of tin-bearing materials, even down to the lowly used can.

During 1942, consumption of tin in the United States dropped steadily under the government's conservation program that struck hard at all classes of consumers. Probably 60,000 tons of tin was used during the year, with the annual rate of disappearance as 1942 ended somewhat in the neighborhood of 40,000 tons. In reducing normal consumption of tin almost 50 percent in the period of twelve months, the War Production Board spared no one's feelings in allocating supplies. The conservation program kept all essential needs supplied without reducing the reserves that were built up in previous years. In a year-end statement by the War Production Board, the 1942 period was described as "a year of learning how to do without tin." Under normal conditions the Far East accounts for more than 70 percent of the world's output of tin.

In a report by the Secretary of Commerce on the activities of the Reconstruction Finance Corp. and its subsidiaries, issued on Oct. 31, 1942, considerable light was shed on the position of tin in the United States. The official statement revealed what had been done in building up the stockpile under the original agreement with the International Tin Committee, starting June 28, 1940, and subsequent extension of the program into 1942. Though the war prevented tin from coming into this country in the tonnage asked for in the extended agreement, it was stated officially that 41,596 tons of metallic tin and 12,728 tons contained in concentrate managed to come through before the supply was cut off through enemy action. In addition, 11,700 tons of tin was imported from China and the Belgian Congo, and tin concentrate arrived here from Bolivia to provide for production of 35,000 tons of tin. This adds up to slightly more than 100,000 tons. Only a small tonnage of tin was sold during the last year out of the stockpile.

The tin smelter in Texas, said to be the "finest" in the world, is being enlarged to handle all of the tin concentrate now available to the United Nations. This will bring the capacity up to at least 90,000 tons of tin a year, against 18,000 tons called for in the initial announcement made in 1941. The smelter, which is being operated for account of the Metals Reserve Co., started producing "Longhorn" brand tin on April 5, 1942, exactly on schedule. Toward the end of the year the rate of production, according to unofficial trade estimates, exceeded 2,000 tons a month, with the trend still sharply upward.

All of the activity in treating imported tin concentrate in this country was not confined to the smelter in Texas, though output elsewhere was of little consequence during the last year because of the ore situation. The American Smelting & Refining Co. produced a small tonnage of primary tin in 1942.

The price situation in tin was unchanged throughout the year, thanks to the policy set by the Office of Price Administration. The average price of "Grade A" tin, comparable with Straits and other grades of tin containing 99.8 percent tin or higher, remained at 52c. a pound, or a shade under the average for 1941.

The Bolivian tin concentrate contract, between various producers in that country and the Metals Reserve Co., was amended on June 29 to lift the settlement basis from approximately 48½c. a pound of tin contained, f.a.s. United States ports, to 60c. a pound f.o.b. South American ports. Patiño's production, which remained tied to the British agreement, also obtained the higher American level as a result of a modified contract with the British Government.

An official of Patiño Mines told stockholders of the company that if for any reason it was found impossible to continue to ship tin concentrate to England, production could be consigned to the United States.

Renewal of the international tin agreement attracted less interest in this country than the event deserved, possibly because of the war. The new accord was signed Sept. 9, 1942, and its effective date was made retroactive to Jan. 1, 1942, which closes the gap between the expiration of the old agreement and the beginning of the new. Extension of the scheme gives a clue to British thinking on controlling production and distribution of this and perhaps other vital raw materials in the post-war period. The fact that high government officials participated in the agreement indicates to those who are following world events closely that control of tin may not be so one-sided an affair as in the pre-war period. The agreement was signed by Anthony Eden for the United Kingdom, A. Patiño for Bolivia, Th. de Lantsheere for Belgium, and E. Teixeira de Mattos for the Netherlands. Within a month after the first meeting of the International Tin Committee takes place, two representatives from the United States will be invited to attend, one to be appointed by the United States government. One representative is to sit in on behalf of all other consumers.

Standard tonnages were tentatively agreed upon by the tin group as follows, figures in long tons:

	Old Agreement	New Agreement
Malaya	77,335	95,474
Nigeria	10,890	15,367
Netherlands East Indies	39,055	55,113
Bolivia	46,027	46,768
Belgian Congo	15,035	20,178
Totals	188,342	232,900

The voting power of the five countries named is: Malaya 5; Netherlands East Indies 4; Bolivia 4; Nigeria 2; Belgian Congo 2. The head office of the control group will be in London.

Commenting on the tin scheme, the London *Economist*, in its issue of Oct. 3, 1942, said: "If the International Tin Committee is to serve as an instrument for the regulation of tin supplies after the war, in the spirit of the Atlantic Charter, its constitution will have to be amended to give the consumer an effective voice in its decisions."

World's Tin Production

Production of tin ore for the world in terms of metal content. For the years 1933 to 1939, the figures are those appearing in the "Yearbook" of the American Bureau of Metal Statistics; 1940 and 1941 estimates by Tin Research Institute; 1942 not available.

(In Long Tons)

1933	90,680
1934	115,832
1935	146,972
1936	180,409
1937	208,220
1938	148,631
1939	183,792
1940	237,800
1941	209,500
1942	*(a)*

(a) **Not available.**

THE LIGHT METALS

Aluminum and magnesium set new output records in this country in 1942, as United Nations improve position in comparison with Axis. Metals under strict control

John H. Weitz *Metal Economics Division, Bureau of Mines, Washington, D. C.*

AS THE DEMAND for airplanes, tanks, ships, guns, and other implements of war increased, the importance of magnesium and aluminum in the war program became greater. From 1939 to 1941 annual production of aluminum nearly doubled, rising from about 163,500 short tons to over 300,000 tons. The War Production Board announced in June, 1942, that the output for that year would be approximately 541,500 tons. Magnesium production increased from only 3,350 short tons in 1939 to an annual rate of over 15,000 tons in April, 1942, or 4.5 times. The 1942 magnesium output considerably exceeded that of 1941, and in 1943 it will be even greater. In addition to the 700,000-ton aluminum program announced in 1941, the War Production Board made public a second program calling for an additional 300,000 tons. At the same time it was announced that Canada will supply 225,000 tons to the United States in 1943. Thus the total supply of primary aluminum in 1943 will be approximately 1,225,000 tons, or 7.5 times the 1939 domestic production. The total cost of this expansion was estimated at $653,000,000, of which private industry is spending $85,000,000. In February, 1942, the War Production Board enlarged the magnesium program from 200,000 tons to 362,500 tons, which soon afterward was revised downward to approximately 300,000 tons. To finance this expansion $339,000,000 will be required, including $20,000,000 to be spent by private industry.

ALUMINUM—Using the commonly accepted ratio of 4 lb. of bauxite to 1 lb. of aluminum, it is apparent that roughly 3,660,000 long tons of high-grade bauxite will be needed to produce 1,000,000 short tons of metal. If it is necessary to mine all of the ore from domestic mines, the total quantity needed will be over 4,000,000 long tons, because Arkansas bauxite contains more silica and less alumina than Guiana bauxite. In addition to requirements for metal, substantial amounts of high-grade bauxite must be allocated for essential abrasive and refractory uses and for certain chemical uses. In 1942 the United States set a new all-time record for bauxite production, far exceeding the 1941 mark. There were 17 producers in 1942, and Arkansas continued to supply well over 90 percent of the domestic output.

Large new stripping operations were opened up during the year to facilitate mining large tonnages of bauxite in the shortest possible time.

A large new Government-owned alumina plant began producing in 1942, making a total of four alumina plants in operation in this country. Two others under construction, plus the four now operating, will supply all of the alumina required by the aluminum expansion program when they are completed.

A report to the War Production Board from the National Research Council Advisory Committee on Metals and Minerals included the following suggestions:

1. "The War Production Board should consider the construction of lime-soda sintering plants in connection with the Bayer process plants. This would enable each Bayer process plant in the United States to operate on high-silica bauxite and it would also make possible the production of a portion of the alumina, in these combination plants, from clay.

2. "The Committee considers a modified Pedersen process for the production of alumina from clay as the most promising process that will be independent of the Bayer process."

Suggestions also were made that the required amount of high-grade bauxite should be set aside for future production of abrasive; that clay should be substituted for bauxite in the production of aluminum sulphate; and that vigorous drilling and prospecting for new bauxite deposits should be undertaken. These suggestions are now being utilized in an effort to make our limited domestic reserves stretch as far as possible. Both bauxite and alumina were brought under complete allocation, effective Aug. 1, 1942, by Order M-1-h. All requests for permission to buy, sell, or use alumina and bauxite must be cleared through the War Production Board. For the purpose of the order, bauxite was divided into two main classes—non-restricted and restricted. Restricted bauxite was defined as containing less than 15 percent silica and was broken down further into high- and low-silica restricted ore, 8 percent silica being the dividing line.

Aluminum production in 1942, based on the June estimate by the War Production Board, was over 500,000 tons and represented a new production record. In addition to new and expanded facilities of the Aluminum Co. of America and the Reynolds Metals Co., a new producer, the Olin Corp., began operations late in 1942.

No change was made during the year in the price of aluminum ingot, which remained steady at 15c. a pound. However, in November, 1942, a price of 14c. a pound for pig aluminum was published for the first time.

In July, 1942, the monopoly charge brought by the Department of Justice against the Aluminum Co. of America was dismissed by a New York Federal Court. The Government filed an appeal to the Supreme Court, which was allowed in September and docketed for Oct. 20. On Nov. 23 the Clerk of the Supreme Court sent a letter to counsel for both sides stating that there was not a quorum of justices eligible to sit on the case. The Aluminum Co. of America immediately moved to dismiss the appeal, but the Department of Justice took steps to keep the case open until a quorum of eligible justices can hear the case and hand down a decision.

The War Production Board issued Order M-1-i, effective Aug. 18, 1942, providing for complete allocation control of primary and secondary aluminum and limiting consumption of the

Light Metals Production

Estimated world production of aluminum and magnesium for the last ten years, so far as available. Prior to 1937, no attempt was made to compile world figures for magnesium.

	(Short Tons) Aluminum	Magnesium
1933.....	156,000	(a)
1934.....	186,800	(a)
1935.....	284,000	(a)
1936.....	406,000	(a)
1937.....	538,500	21,800
1938.....	638,000	27,500
1939.....	735,000	35,000
1940.....	885,000	44,000
1941.....	1,200,000	(a)
1942.....	(a)	(a)

(a) Not available.

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E & M J
Annual Average Metal Prices 1898-1942

Year	Copper (a) Electrolytic, Refinery	Tin, (b) New York	Lead Common, New York	Silver, New York	Zinc, Prime Western (d) E. St. Louis
1898	12.03	15.70	3.78	58.260	4.57
1899	16.67	25.12	4.47	59.580	5.75
1900	16.19	29.90	4.37	61.330	4.39
1901	16.11	16.74	4.33	58.950	4.07
1902	11.626	26.79	4.069	52.160	4.84
1903	13.235	28.09	4.237	53.570	5.191
1904	12.823	27.99	4.309	57.221	4.931
1905	15.590	31.358	4.707	60.352	5.730
1906	19.278	39.819	5.657	66.791	6.048
1907	20.004	38.166	5.325	65.237	5.812
1908	13.208	29.465	4.200	52.864	4.578
1909	12.982	29.725	4.273	51.502	5.352
1910	12.738	34.123	4.446	53.486	5.370
1911	12.376	42.281	4.420	53.340	5.608
1912	16.341	46.096	4.471	60.835	6.799
1913	15.269	44.252	4.370	59.791	5.504
1914	13.602	34.301 (c)	3.862	54.811	5.061
1915	17.275	38.590	4.673	49.684	13.054
1916	27.202	43.480	6.858	65.661	12.634
1917	27.180	61.802	8.787	81.417	8.813
1918	24.628	88.750	7.413	96.772	7.890
1919	18.691	63.328	5.759	111.122	6.988
1920	17.456	48.273	7.957	100.900	7.671
1921	12.502	29.916	4.545	62.654	4.655
1922	13.382	32.554	5.734	67.528	5.716
1923	14.421	42.664	7.267	64.873	6.607
1924	13.024	50.176	8.097	66.781	6.344
1925	14.042	57.893	9.020	69.065	7.622
1926	13.795	65.285	8.417	62.107	7.337
1927	12.920	64.353	6.755	56.370	6.242
1928	14.570	50.427	6.305	58.176	6.027
1929	18.107	45.155	6.833	52.993	6.512
1930	12.982	31.694	5.517	38.154	4.556
1931	8.116	24.467	4.243	28.700	3.640
1932	5.555	22.017	3.180	27.892	2.876
1933	7.025	39.110	3.869	34.727	4.029
1934	8.428	52.191	3.860	47.973 (e)	4.158
1935	8.649	50.420	4.065	64.273 (e)	4.328
1936	9.474	46.441	4.710	45.087 (e)	4.901
1937	13.167	54.337	6.009	44.883 (e)	6.519
1938	10.000	42.301	4.739	43.225 (e)	4.610
1939	10.965	50.323	5.053	39.082 (e)	5.110
1940	11.296	49.827	5.179	34.773 (e)	6.335
1941	11.797	52.018	5.793	34.783 (e)	7.474
1942	11.775	52.000	6.481	38.333 (e)	8.250

(a) Lake copper 1898; domestic copper only since 1932. (b) 99 per cent tin, 1898 to 1920, inclusive; Straits quality tin thereafter. (c) Average for eleven months. (d) New York zinc 1898 to 1902, inclusive. (e) Other than newly mined domestic.

Prices are in cents per pound, except those for silver, which are in cents per troy ounce.

metal to essential uses. On Jan. 7, 1942, Order M-1-d prohibited the use of scrap (except home scrap) containing more than 15 percent aluminum without the authorization of the Director General for Operations. This order does not apply to primary producers or approved smelters.

MAGNESIUM—Domestic magnesium production reached a new all-time high in 1942, considerably exceeding the previous record set in 1941. During the year eight new plants with a rated annual capacity of 162,000 tons were brought into production, and four others were rapidly being pushed to completion. Dow Chemical Co. continued to be by far the largest producer of the metal, but in 1943 other companies will supply a substantial share of the output. Magnesium is at the present time being produced by three basically different general processes—electrolytic, carbothermic, and ferrosilicon.

In August, 1942, the Basic Magnesium, Inc., plant in Nevada began producing metal. The rated capacity of the plant is roughly 3½ times the entire United States output in 1941. Only ten months were required to complete this huge plant, which uses a standard electrolytic process. Earlier in the year the new Dow Magnesium Co. plant in Texas, the Ford Motor Co. plant in Michigan, the Permanente Metals Corporation plant in Calif., and the New England Lime Co. plant in Connecticut started production. The last three plants are using the new Pidgeon process, by which dolomite is reacted with ferrosilicon at an elevated temperature and low pressure to produce pure magnesium metal. Three other ferrosilicon-process plants are to be completed in the first part of 1943.

In addition to the plants mentioned in the foregoing three more using electrolytic processes began production in 1942, but the names and locations have not yet been announced. Another large electrolytic plant is scheduled for completion in 1943.

During 1942 Axis gains of bauxite in southeastern Asia by Japan were of great importance. Since the outbreak of war the large bauxite reserves in Hungary and Italy have been augmented by the acquisition of those in France, Yugoslavia, Greece, Netherlands East Indies, and Malaya.

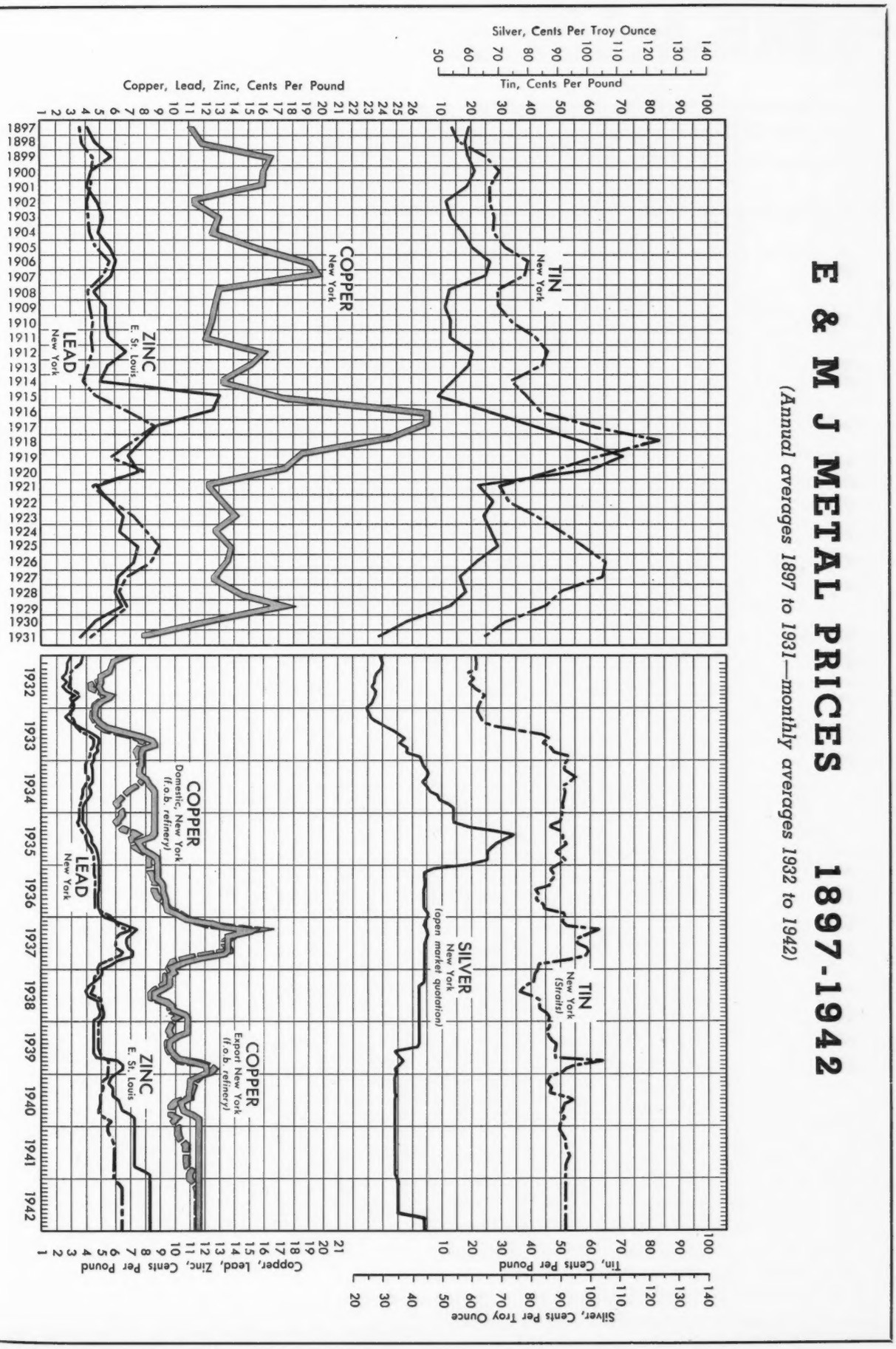
Since 1939 all Axis nations are believed to have greatly increased their production of aluminum. Germany is estimated to have increased its output from 200,000 tons in 1939 to 400,000 tons in 1942 and to have constructed facilities boosting Norway's production to 50,000 tons in 1942. Ultimately it is reported that Norway is slated to produce at the rate of 150,000 tons annually for the Axis. Norway has no reserves of bauxite and must import all it requires, as well as much of its alumina. It is reported that a plant now in operation in Norway produces alumina from aluminous silicates, but the quantity is not believed to be adequate materially to cut down imports of bauxite and alumina. Spain is said to be constructing an aluminum plant of 10,000 tons' capacity. Although Japan's production of aluminum was believed by some to be as high as 150,000 tons in 1941, it appears doubtful that the 1942 output exceeded 70,000 tons.

The United Nations are growing steadily stronger in their aluminum position in comparison with the Axis. Bauxite is being produced in the United States in quantities undreamed of two years ago. The output from British Guiana and Surinam has greatly increased over that of 1939. Important new facilities for alumina and aluminum in Canada and the United States have increased output to several times the 1939 figure, and production in both countries will again be greatly raised in 1943. Russia and England are believed to have retained about the same production rate as in 1941. It is estimated that in 1942 the United Nations controlled more than half of the world aluminum output and bauxite production.

Estimates indicate that in 1942 the United Nations may, for the first time, have exceeded Axis production of magnesium. The major share in the greatly increased Allied production belongs to the United States, which has achieved a position in which it can produce more than the entire group of Axis nations in 1943.

E & M J METAL PRICES 1897-1942

(Annual averages 1897 to 1931—monthly averages 1932 to 1942)



FERRO-ALLOY METALS

Stimulation of production by government agencies has beneficial results. Some new sources are disclosed. Manganese position distinctly easier

Metal Economics Division *Bureau of Mines, Washington, D. C.*

VARIOUS LIMITATIONS and restrictions on the publication of mineral statistics prevent the release of current data on production, stocks, and consumption of the metals covered in this brief review. Chromite, molybdenum, vanadium, tungsten, and manganese have extremely important war uses. The authors of the individual summaries are designated.

CHROMITE—The chromite industry has experienced two years of increasing activity. Many projects for procuring and utilizing domestic ores were considered during 1941 and 1942, and some of these have already yielded tangible results. The outstanding development has been the opening of the Stillwater deposits in Montana. The Stillwater chromite is being mined and milled by the Anaconda Copper Mining Co., designated as operator by the government, which is financing the project, undoubtedly the largest chromite venture as yet undertaken in this country.

California has long been the center of domestic chromite mining, but most of the operations are small. A few old properties which were active during the first World War have been revived or are being explored for present possibilities. In Oregon similar work is in progress. Particular interest attaches to the Oregon beach sands, under investigation by the government and private interests. Large reserves of low-grade chromite are indicated, and plans are going forward to produce concentrates. Space does not permit enumeration of other chromite operations.

Late in 1941 the Metals Reserve Co. undertook to purchase on a contract basis chromite ore produced in continental United States. The purchasing schedule was revised on Feb. 20, 1942, to include chromite concentrates. If briqueted, concentrates were acceptable under terms and prices established for ore. Unconsolidated concentrates, if of "High Grade" and "Low-Grade A," were to be purchased, but with a discount of $3 per long ton. On March 5 the purchasing program was extended to include truckload lots of chromite produced in Oregon and northern California and delivered at nearby depots. Ore or concentrates so delivered is not acceptable as delivery on contracts made under earlier schedules. A further revision of the circular relating to purchase of contract lots (1,000 to 10,000 long tons) was released on May 25. Therein it was stated that Low-Grade A and B ore will be accepted to a minimum of 35 percent Cr_2O_3, or 5 percent below the previously established minimum of 40 percent. A penalty of $1.40 for Low-Grade A and $1.20 for Low-Grade B is imposed for each long dry-ton unit of Cr_2O_3 below 40 percent. The maximum size of ore was fixed at 12 in. A similar revision was announced for truck-load lots on June 1. The base prices per long dry ton now in effect are as follows:

	High Grade	Low Grade A	Low Grade B
Base price....	$40.50	$28.00	$24.00
Specifications:			
Cr_2O_3 ..min.	45.00%	40.00%	40.00%
SiO_2 ..max.	11.00	13.00	None
P. ....max.	0.20	0.50	None
S ....max.	0.50	1.00	None
Cr : Fe ratio min.	2.5 :1	2.1 :1	

Ceiling prices for chrome ore were established by the Office of Price Administration on Nov. 3, 1942, in Maximum Price Regulation 258. These do not apply to sales to the government or where the contract is made and title vests in the buyer while the ore is still outside continental United States. The ceilings are based on prevailing levels for metallurgical-chemical ores during the first six months of 1942 and for refractory ores are between first-half 1942 prices and those current when the regulation was issued. The prices f.o.b. railroad cars at favorable basing points for buyers, detailed in the regulation, are the following:

Metallurgical-Chemical Ores

Base analysis: Cr_2O_3, 48%; Cr :Fe is 3.0 :1
Base price.....per long ton (*a*) $43.50

(*a*) For Montana ores and concentrates, base is f.o.b. railroad cars at Columbus, Mont., with an allowance to buyer for actual freight not in excess of $7 per long ton.

Refractory Ores

Lump ore (in bulk)...per long ton	$31.00
Ground ore (24-mesh or coarser) in bulk.....per short ton	36.50

The War Production Board in an order dated Jan. 13, 1942, prohibited the melting of more than two tons of ferrochromium in a given month without specific authorization. In February deliveries of chromium, chromite, ferrochrome, metallic chromium, etc., were placed under complete allocation, and it was further ordered that no chromium might be melted without permission. Inventories are now limited to one month's supply.

Frederick Betz, Jr.

MANGANESE—The present United States position as regards manganese is best illustrated by the fact that ferromanganese has recently been placed in Group III (materials of which supplies are adequate for all appropriate types of present demands, including use as substitutes) by the War Production Board. Silicomanganese, second in importance as a high-manganese ferro-alloy, is classified in Group II—materials that are essential to the war industries but not as limited in supply as those in Group I, which are too scarce for war and essential use. The bulk of all manganese additions to steel is in the form of these two alloys, and 95 percent of all manganese ore used in this country is consumed in their manufacture. Domestic stocks of ore at the end of October, 1942, were sufficient to last 18 months at current rate of consumption.

Domestic production has increased greatly during 1942, chiefly as a result of the relatively high price being paid by the U. S. government for domestic ore. The current prices, f.o.b. mines, made effective May 4, 1942, for Metals Reserve Co. purchases are $1 per long-ton unit for ore containing 48 percent or more manganese; 80c. per long-ton unit for ore having a manganese content of 44 percent or more; 65c. per unit for ore containing a minimum of 40 percent manganese; and approximately 56c. per unit for minimum grade ore containing 35 percent manganese. In addition, there are penalties for excess amounts of impurities.

The prices paid by the Metals Reserve Co. are not affected by Maximum Price Regulation 248 (effective Nov. 9, 1942), fixing the price of all manganese ore except battery and chemical ore. Manganese ore was first defined as ore containing a minimum of 35 percent manganese, but this specification was later raised to 40 percent. The maximum prices, disregarding premiums and penalties, are fixed at 85c. f.o.b. railroad cars Mobile and New Orleans; 90c. f.o.b. cars Norfolk, Baltimore, Philadelphia, and New York; and 96c. f.o.b. cars Fontana, Pueblo, and Provo.

The United Nations have a considerable edge over the Axis as regards total supplies of manganese ore. It

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is estimated that manganese ore production available to the Axis Powers is about 1,800,000 long tons per annum, whereas that of the United Nations is about 3,400,000 tons. However, in comparing the output of manganese ore with relation to steel capacity, this advantage is not nearly so overwhelming—The United Nations manganese production per ton of steel capacity is only about 10 percent greater than that of the Axis; and the present supply of both the Axis and the United Nations is adequate to maintain full operation of steel-making capacity.

Norwood B. Melcher

VANADIUM—Supplies of vanadium ores and concentrates in the United States have been obtained principally from Colorado, Utah, and Peru. In recent years attention has been directed to other sources, such as phosphate rock; certain fuel oils, and titaniferous magnetites. Research has confirmed the already known fact that vanadium occurs in various organic and inorganic substances, but earlier determinations were not always concerned with the commercial possibilities of such sources. Vanadium ore deposits are not common. However, it is known that recovery of vanadium from sources other than vanadium ore apparently supplies the needs of certain foreign countries.

During 1942 milling facilities were expanded in the Colorado-Utah region, which has supplied the bulk of domestic ores. In Colorado, the new plant of the U. S. Vanadium Corp. was put in operation early in the year. This operator also undertook to build two other mills in Colorado; one was completed during the year. The government has offered to assist producers by Defense Plant Corp. loans and by establishing a program for the purchase of Colorado-Utah standstone ores and lead vanadate ores from the Southwest. The U. S. Vanadium Corp. is buying for Metals Reserve.

The Anaconda company recovers vanadium in treating phosphate rock to produce fertilizer. The process was described briefly in *E. & M. J.* (October, 1942, p. 61). Further vanadium-bearing phosphate rock is to be mined in western Wyoming, where the Wyodak Coal & Manufacturing Co., Homestake subsidiary, will operate for Metals Reserve. The deposit, recently discovered, is being investigated by the government. Publicity was given by the American Chemical Society to a method of extracting vanadium from phosphate rock with better recovery.

The price quoted for vanadium ore is nominal. It is given as 27½c. per pound of contained V_2O_5. In practice, price schedules have been maintained by the principal purchasers for various grades of ore.

Vanadium has been under complete allocation by the government since December, 1941. Then, specific authorization was required for all deliveries exceeding 50 lb. of vanadium per month. An amendment in June, 1942, placed inventories, as well as deliveries, under WPB control. Melting of vanadium and deliveries of more than 10 lb. per month must be authorized.

Frederick Betz, Jr.

TUNGSTEN—Despite labor shortages at some mines, production of tungsten concentrates reached a new peak in 1942, and, notwithstanding shipping difficulties, imports were well maintained; supplies were thus more than ample to meet the restricted consumption, which, however, attained a new high. Labor shortage was relieved somewhat when the Army released some soldiers.

Much prospecting and development work was done on tungsten during 1942, which led to discovery of additional orebodies and the opening of new properties. New mills were operated at several mines. The Bureaus of Mines and the Geological Survey continued to search for commercial deposits.

The treatment plant of Metals Reserve Co., in Utah, is to be completed early in 1943. To be operated by U. S. Vanadium, it will treat ore and low-grade concentrates from many sources. Pending its completion, a stockpile is being accumulated.

About half the mill equipment of Talache Mines, Inc., was changed to treat tungsten ore from the company property in Idaho; it began operating in April. The mill of Getchell Mines, Inc., in Nevada, began operating in September and treated both company and custom ores. These mills produce a low-grade concentrate, which is shipped for further milling.

Throughout 1942 foreign ores and concentrates were nominally quoted by *E.&M.J. Metal and Mineral Markets* at $24 a short-ton unit of WO_3, duty paid, and domestic scheelite, in carlots, delivered, at $26 a short-ton unit. The government buying price of South American tungsten ores and concentrates was $21 a short-ton unit, c.i.f. New York, and for domestic concentrates from eligible producers $24 a unit, delivered at New York. The latter price was increased to $30 a unit in November and will continue in effect until Dec. 31, 1943.

General Preference Order M-14 (Nov. 29, 1941), designed to conserve tungsten by providing that 75 percent of all high-speed steel orders shall be of the molybdenum type and not more than 25 percent of the tungsten type, was in effect during 1942. WPB Order M-29-b (Feb. 14, 1942) restricted or prohibited the use of tungsten for various minor articles. WPB Order M-29 (Aug. 30, 1941), which placed deliveries of ferrotungsten and tungsten metal compounds and powder under allocation, was amended (June 30, 1942) to bring ores and concentrates under allocation also.

H. W. Davis

MOLYBDENUM—The United States has long been established as the world's leading molybdenum producer, largely owing to the great output from the Climax deposit. There have never been many molybdenum operations, as deposits of commercial value are not common, although this element occurs widely in nature. Aside from Climax, the only consistent domestic producer in the last 20 lears has been the Questa mine, in New Mexico. More recently, recovery of molybdenum from copper concentrates was begun in Arizona, New Mexico, and Utah. Molybdenum is also won from complex ore in Arizona and from an association with tungsten ore in California. Most producers are concerned primarily with other ores; therefore changes in molybdenum production depend in part on the production level of these other ores, copper in particular. Expansion at the mine and mill is highly important to domestic output. Facilities for processing ores and concentrates have also been expanded to permit an increased flow of molybdenum in forms suitable for use in the manufacture of iron and steel and other products.

In August an announcement was made that the Defense Plant Corp. had purchased the Urad mine, in Colorado, from the Vanadium Corp. of America, for $110,000. The property is being developed and will be operated by the Molybdenum Corp. of America. For development work, $250,000 has been allotted, and an additional $500,000 will be available to erect a mill. Plans now call for a mill to be ready for operation by the middle of 1943. The Urad mine was a producer during the first World War, but it has been idle since 1919.

Molybdenum was placed under allocation by the War Production Board in General Preference Order M-110, effective May 1, 1942. All deliveries were controlled through this order. Inventories were also subjected to control in August, when monthly approval of processing schedules was required by the Board. An amendment to the order in November relaxed the control to permit delivery and processing in quantities up to 500 lb. in a given month for use in products other than iron and steel.

Molybdenum was quoted at the nominal price of 45c. per pound of contained MoS_2 for 90 percent concentrates during 1942.

Frederick Betz, Jr.

THE MINOR METALS

Commodities of group controlled in varying degree. Many are important strategically and the supply of each is being safeguarded

Metal Economics Division *Bureau of Mines, Washington, D. C.*

VARIOUS RESTRICTIONS have been imposed on the publication of mineral statistics which prevent release of data on current production, stocks, and consumption for almost all of the metals covered in this brief review. Each of the nine metals covered has important war uses. The authors of the individual summaries are designated.

ANTIMONY—Consumption of antimony in 1942 was restricted to essential needs, and under the use limitations the supply was adequate to meet requirements. As in 1941, the supply, from sources outside of the United States, depended largely on Mexican and Bolivian ores. The development of Western Hemisphere deposits during 1941 and 1942 to a great extent supplanted the need for Chinese metal, and it is likely that this condition will continue, at least to a considerable extent, for some time.

Because of informal government control through the Office of Price Administration, the price of ore showed little change in 1942. The 50 to 55 percent ores quoted at $2 to $2.15 per short-ton unit, New York, at the beginning of 1942 were priced at $2.15 to $2.30 at the close of the year. The quotation for domestic metal—14c. per pound, New York, on Jan. 1, 1942—was allowed to increase to 16.013c. on April 13, where it remained throughout 1942. On Dec. 1 the 3 percent property transportation tax became effective, and although the increased cost in the form of added freight charges is chargeable to the buyer, this was not reflected in December's quotation.

In 1942 primary antimony for shipment to others was produced from foreign and domestic ores from two of the three plants that supplied metal in 1941. The new electrolytic plant of the Sunshine Mining Co. started operations at the end of 1942 following several months' successful operation of the pilot plant.

To insure the flow of available supplies to essential war industries, the War Production Board found it necessary to issue General Preference Order M-112, effective March 30, 1942, which placed antimony in all forms (except alloys containing less than 50 percent by weight of antimony) under complete allocation. As an inducement to increase mine production, this order was amended July 11 to allow unrestricted monthly deliveries of antimony ore and concentrates containing up to 50 tons of antimony from domestic mines, including Alaska. An additional indirect curtailment in the use of antimony was effected by War Production Board Order M-38-c of Jan. 10, 1942, which restricted the use of lead.

Alfred L. Ransome

ARSENIC—The figure for total domestic production of white arsenic in 1942 probably will be even higher than the record output of 32,481 short tons in 1941, due to general expansion of all non-ferrous production from which white arsenic is a byproduct. Imports gained over those for 1941, and the total new supply sufficed for requirements, which were greater in 1942, largely due to the increased demand for use in insecticides.

Despite the increased supply, deliveries of calcium arsenate to the cotton belt were tight during the late summer months. The Department of Agriculture has stated that no insecticide has ever been discovered for boll weevil control that gives as good results as calcium arsenate dust. However, many growers in 1942 necessarily added nicotine to calcium arsenate to prevent damage from aphids or plant lice. Demand for lead arsenate was rather light. Quotations for white arsenic remained unchanged throughout 1942 at 4c. a pound, delivered, car lots. The potential supply of arsenic could be enlarged materially by reopening the Gold Hill mine, in Utah, which operated during the last war. Substitutes for arsenical compounds are limited, but salt and borax may be used instead for weed killers, and pentachlorophenol and creosote as wood preservatives.

Arsenic was placed under control of the Director General for Operations by issuance of General Conservation Order M-152 on May 22, 1942.

Alfred L. Ransome

BERYLLIUM—Production of beryllium-copper alloys for instrument and engine parts was increased in 1942 to meet the growing needs of the aircraft industry. Plant capacity was expanded, partly on the basis of assistance from the Defense Plant Corp. All beryllium materials were put under allocation control on June 1 by War Production Board General Preference Order M-160. The 4 percent beryllium-copper master alloy continued to be quoted at $15 per pound of contained Be by one producer but was increased to $17 by the other. The price of beryllium ore, 10 to 12 percent BeO, doubled during 1942 to $75 to $100 a short ton. Brazil remains the most important source of ore. Argentina had an embargo on beryl exports during most of 1942; although this was lifted late in the year, the reserves of the most important mine (Las Tapias) are becoming depleted. Domestic beryl output increased somewhat in 1942. Most promising is the helvite-danalite deposit in New Mexico; explorations completed by July indicated a relatively substantial tonnage of low-grade ore that may prove to be an important source of beryllium.

Allan F. Matthews

BISMUTH—The demand for bismuth increased in 1942, largely for consumption in alloys used in expanded war industries for anchoring parts, setting dies, tube bending, pattern work, and solders. The use of bismuth in pharmaceutical applications continued to consume a large share of the total but probably was second to the metallurgical applications. Civilian requirements are currently controlled by informal restrictions. The adequacy of future supplies with respect to demand is problematical, as military and other essential needs are variable. The nominal price of the metal remained steady throughout the year at $1.25 per pound, in ton lots.

Alfred L. Ransome

CADMIUM—Production of cadmium during most of 1942 was maintained at the previous year's level and was increased further in the closing months as the effect of new installations was felt. A new record production was thus established in 1942. The plating of aircraft, ordnance, automotive, marine, and electrical parts took increasing quantities of cadmium at the expense of bearing alloys and pigments. Available supplies were conserved by substitution with zinc and by elimination of non-essential uses, such as hardware, building supplies, and

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house furnishings, in accordance with Office of Production Management Order M-65-a issued on Jan. 17, 1942. Order M-65 of the same date prohibited delivery to plants having more than a two months' inventory. The order was amended on June 24 to place cadmium under allocation control. The price of cadmium throughout 1942 was 90c. a pound for sticks and 95c. for anode shapes, the level fixed by Office of Price Administration Price Schedule No. 71 on Jan. 19, 1942.

Allan F. Matthews

M-39-b, as amended June, 6 permitted the use of nickel-cobalt oxide in the manufacture of ground-coat frit, provided that the cobalt-nickel combination cannot be separated advantageously.

Domestic quotations for metal in 100-lb. lots and for black oxide in 350-lb. lots remained unchanged throughout 1942 at $1.50 and $1.84 a pound, respectively. These prices have been in effect since the latter part of October, 1939.

H. W. Davis

Yearly Average Prices Miscellaneous Metals

Year	Aluminum	Antimony	Cadmium	Quicksilver	Platinum
1942.....	15.000	15.559	(a) 90.000	196.346	36.000
1941.....	16.500	14.000	(a) 88.443	185.023	36.000
1940.....	18.691	14.000	(a) 79.920	176.865	37.924
1939.....	20.000	12.359	(a) 59.180	103.940	36.748
1938.....	20.000	12.349	98.037	75.469	35.901
1937.....	19.917	15.355	122.335	90.180	51.773
1936.....	20.000	12.240	97.789	79.917	42.926
1935.....	20.000	13.616	70.491	71.992	34.150
1934.....	23.300	8.901	55.000	73.865	36.465
1933.....	23.300	6.528	55.000	59.227	30.993
1932.....	23.300	5.592	55.000	57.925	36.455
1931.....	23.300	6.720	56.010	87.351	35.665

Quotations for aluminum, antimony, and cadmium in cents per pound; quicksilver in dollars per flask of 76 pounds; platinum, refined, in dollars per troy ounce. *(a)* Commercial sticks, producers quotation.

COBALT—Consumption of cobalt in the United States increased phenomenally in 1942, notwithstanding prohibitions and limitations placed on its use in many items. As heretofore, most of the demand was supplied by imports, mainly in the form of ore and residues, which are converted to metal and other products and for which present capacity is adequate to meet objectives. Although comparatively small, domestic production of ore made a substantial gain in 1942, and most of it was a byproduct of the iron ore mined at Cornwall, Pa. The St. Louis Smelting & Refining Co. is developing a property in Madison County, Mo., and hopes to begin actual production of cobalt sometime during 1943.

General Preference Order M-39, as amended on Feb. 7, 1942, placed cobalt in all forms under complete allocation. Conservation Order M-39-b, issued on Feb. 7, 1942, limited the use of cobalt in ceramics, glass, enamel ware, inks, paints, stains, and pottery from Feb. 1 to April 30 and prohibited such use after April 30. Limitations were placed on the use of cobalt in all other items except high-speed steel, cobalt alloys, magnets, driers, ground-coat frit, and related items. Order

MERCURY—Restrictive government action in regard to both consumption and price was taken in the first two months of 1942. Conservation Order M-78, issued Jan. 23, prohibited certain uses considered to be non-essential (such as the carroting of hat fur and the manufacture of vermilion) and curtailed most others. Consumption dropped temporarily, as a result of this order, while supplies were augmented by increased imports. Further restrictive action was taken on Aug. 5, when use in a few additional items was discontinued and mercury for use in the manufacture of cosmetics was cut to 30 percent. Although threatened almost twelve months sooner, government action in establishing ceiling prices for mercury was delayed until February. Ceiling prices of $191 and $193 a flask, f.o.b. point of shipment for domestic and f.o.b. port of entry for foreign mercury, at several stages of the investigations would have been considered generous. In taking action, however, the price agency had no wish to disturb the favorable rate of domestic production. In April, when permitted consumption lagged behind available supplies, the Metals Reserve Co. arranged to purchase surplus spot mercury from current domestic production at $192 a flask, f.o.b. New York. The program was enlarged in July to make it possible to dispose of metal at purchase depots established at many points throughout the country, and at that time it was extended conditionally through Dec. 31, 1943.

H. M. Meyer

PLATINUM METALS—In contrast to the first World War, when the available quantities of platinum, palladium, and iridium for essential war needs were so short that the War Department had to requisition stocks held by a large number of refiners and consumers, supplies of platinum and palladium have been ample for both war and non-war purposes, and by prohibiting the use of iridium in jewelry the supply has sufficed for war needs. However, to assure that adequate platinum will be available to meet greatly expanding demands for war purposes, its sale for use in jewelry was prohibited on and after Oct. 31, 1942. Whereas there was little or no demand for rhodium, ruthenium, and osmium in the first World War, these metals are now being used for a variety of war applications. The use of rhodium alloys and rhodium plating in the manufacture of jewelry and other articles of personal adornment has been prohibited since March 11, 1942.

Platinum, palladium, and iridium were quoted at $36, $24, and $160 to $175 an ounce, respectively, throughout 1942, which compares with prices of $105, $135, and $175 an ounce, respectively, fixed by the War Industries Board in May 1918. Osmium, rhodium, and ruthenium were quoted at $45 to $48, $125, and $35 to $40 an ounce, respectively, in 1942.

Practically the entire world supply of platinum metals is produced by the United Nations.

H. W. Davis

TITANIUM—Large-scale production of ilmenite at Newcomb, N. Y., was begun in August by the National Lead Co., and the daily output is expected to reach 800 long tons of concentrates containing up to 48 percent TiO_2. This operation, supplemented by small domestic and Canadian mines, can meet anticipated requirements of the titanium pigment industry for many years. There was increased activity in Arkansas rutile deposits in 1942. The demand for rutile-coated rods was stimulated by the growth of welding as a streamlined method of assembling war machines. Throughout 1942 the nominal price of ilmenite, 60 percent TiO_2, was $28 to $30 a long ton, f.o.b. Atlantic seaboard, and that of rutile, 94 percent TiO_2, was 8c. to 10c. a pound.

Allan F. Matthews

SCRAP METALS

Industry under constant pressure to meet growing war demands. Unusual and numerous price regulations for scrap and secondary metals issued during 1942

Samuel Tzach *Scrap Metal Editor, E.&M.J. Metal and Mineral Markets*

IN A WAR ECONOMY, scrap's role of being there "firstest with the mostest"—readily available and with high concentrations of metal content—was necessarily highlighted in 1942.

The controls set up on scrap and secondary metals are too numerous to mention in this article, and, generally speaking, they followed and were part of the controls set up on primary metals. Scrap prices are normally more sensitive to shifts in the demand-supply relationship than prices of primary metals, and in a period of priorities and shortages, metal consumers turned to scrap—many of them had never used it before—so that, for example, aluminum and zinc scrap prices at the time ceilings were imposed ran 5c. to 10c. a pound above primary metal levels, and nickel scrap was as high as $1.25 a pound.

This article will not go into the logic or wisdom of some of the measures taken by the Price Administration in setting scrap ceilings and regulations for the highly complicated and concatenated industry. Interesting in a market way is its setting of scrap ceilings for consumer purchases on an f.o.b. shipping point basis, because of the adjustments that had to be made subsequently. Before price control, scrap consumers generally purchased on a delivered basis, so that it might be said theoretically that the highest bidder first filled his needs and so downward. The f.o.b. shipping point basis gave shippers equal selling levels and, conversely, seemingly put consumers on the same footing in any district or markets where there was scrap to be had. But because consumers' requirements vary as to grades or amounts of particular grades purchased, and as to prices they are willing to pay for scrap worth less than ceilings in conjunction with purchases of more urgently needed scrap at ceilings, and inasmuch as there was a variation in the amount they could or were willing to pay for freight in the face of a single fixed delivered basis in sales of their products, competitive factors can hardly be said to have been lessened.

Freight costs or allowances, in fact, set up a new problem. A big part of the scrap sold is shipped by dealers in their own trucks, and dealers "went into the transportation business." Consumers found it difficult to set allowances for this trucking, and a measure of competition was set up in the making of these allowances. The result was the Price Administration had to set up fixed trucking allowances. (It might be added that even when scrap purchase allocations came, as in copper and brass, competition was as active as before.) Another result was that, when railroad freight charges were raised 6 percent in March, OPA had to try—unsuccessfully—to get the rise rescinded. As the secondary smelter bought his scrap at shipping-point ceilings and sold his product at delivered ceilings, this freight cost rise might be doubled. If scrap buying ceilings had followed the trade's delivered-basis custom, the freight charges would have been adjusted automatically downward to the dealer and beyond. Similar considerations relate to the 3 percent revenue tax on freight charges that went into effect Dec. 2, 1942.

Broadly speaking, OPA cooperated with the War Production Board, as did Metals Reserve, to speed the ordinarily available scrap into war use and to increase supplies by drives to bring out dormant metal. In addition to the conservation orders, priority ratings, and allocation control, WPB instituted strict segregation of scrap at originating plants, according to alloys and physical condition, so that the scrap could, wherever possible, go back to the producer of the metal or alloy. Aluminum and its alloys and brass mill scrap are prominently in this category. In addition, brass mill scrap in the hands of dealers could be sold only to brass mills, except by special permission, and aluminum scrap could be sold for melting and refining only to an approved list of consumers. Toll and refining arrangements for refining scrap and residues were also put under surveillance by WPB, and seemingly encouraged where necessary by exemption from ceiling controls. To prevent piling up of scrap at dealers' plants, a 60-day turnover provision was set up for graded material. Auto wreckers were practically hounded to wreck old "jalopies," mainly for the steel but also for the hundred pounds or so of non-ferrous scrap in each car. From February through October, 4,000,000 cars were wrecked.

To add to the scrap supplies, public drives to bring out household and industrial material and involving a tremendous amount of publicity and community effort were inaugurated. More important for non-ferrous metals were purchases by Metals Reserve of metal and scrap frozen by conservation orders. In addition, a WPB division has brought in scrap tied up by legal and other obstacles. Increased plant scrap segregation and public drives have tended to put the junkman and even the small dealer out of business.

Channeling scrap to meet the war needs has been a major concern of WPB. Specifications of our service procurement offices are strict, having been formulated on the basis of a

Recovery of Secondary Metals from Purchased Scrap
(In Short Tons)

	1940	% From New	% From Old	1941	% From New	% From Old
Copper	532,046	37	63	726,396	69	31
Lead	260,346	13	87	397,416	4(a)	96
Zinc	222,013	71	29	283,967	71	29
Aluminum	80,362	43	57	106,857	59	41
Tin	33,222	38	62	42,033	30	70
Antimony	11,421	2	98	21,629	..	99.7
Nickel	4,152	53	47	5,315	60	40

Tonnage figures from Bureau of Mines; not absolutely comparable.

Purchased scrap includes toll material and scrap transferred between plants of a single company and excludes metal reused in originating plants.

(a) Previous year included recovery from certain drosses.

plentiful supply of highly refined metals. Brass for shells, for instance, calls for electrolytic or equivalent fire-refined copper and the higher grades of zinc, and WPB was therefore interested in boosting the production of electrolytic copper from scrap. Putting scrap purchases under stricter and ultimately complete allocation for ingot makers and foundries, without limiting custom smelters, did not solve the problem, so that Metals Reserve in April gave refineries contracts to buy for it "refinery" brass scrap at prices that indicated a cost of about 13.25c. to 13.50c. for the electrolytic resulting —in other words, a premium of 1.25 to 1.50c. per pound for secondary electrolytic. This premium was rescinded in August, when the contract basis was cut 1.25c. per pound of copper so as to bring the cost more nearly down to the 12c. ceiling level. At a July meeting in New York, WPB officials indicated that the current custom smelter output of electrolytic copper from scrap was 10,000 tons a month, of which 5,900 tons were involved in MRC-purchased scrap. It is doubtful that since then this figure has been attained, because in the meantime stocks of yellow scrap had somewhat dried up and more of it was going for ingot making and foundry melts. Some of the service specifications calling for high-tin brass alloy ingot had been changed to allow a larger use of the ordinary red brass alloy 85-5-5-5, and even of ordinary yellow ingot or scrap.

WPB, also in July, set on foot plans for ingot makers to go generally into the making of "black" copper by blast furnace-treatment of copper-bearing material like ashes and skimmings. The plans visioned a black copper (80 percent content) output at the rate ultimately of about 15,000 tons per year, the metal to go to a Western smelter to be turned into blister. Some contracts were reported let by MRC to make this black copper, but so far they do not appear to have involved any large tonnages. Normally some of the larger ingot makers make a black copper, mainly from their own residues, but mostly for their own use. In addition, Phelps Dodge's smelter at Clarkdale, Ariz., in the second half of the year became an outlet for refinery brass and copper-bearing material. Around mid-year the supplies of copper-bearing materials seemed burdensome, but toward the year-end the demand outran the offerings. Some heavy tonnages of scrap and residues running 15 percent and below were reported available, but dealers have found it unprofitable to pick up and ship this scrap on the basis of the copper price and smelting charges.

Not even all brass scrap normally

(*Continued on page* 156)

GOLD

Year sees decline in production and in U. S. monetary stocks. Trends reversed in international movements of the metal. Industry "non-essential" for duration

By a Correspondent *Washington, D. C.*

IN 1942 GOLD PRODUCTION SUFFERED the impact of total war on normal peace-time pursuits, while wartime distortions of international trade and war-born innovations in settling international balances reversed previous trends in international gold movements. World production outside Russia declined 9 percent after having advanced uninterruptedly since 1928, and the monetary gold stock of the United States actually declined in 1942.

Gold mining throughout the world encountered rising costs, which exerted a restraining influence on production. A more important deterrent was the inability to compete with the war machine for labor, materials, and equipment. It became increasingly difficult to obtain allocation of such resources for mining a metal such as gold, which was without large-scale industrial uses. Efforts were made in many countries to divert labor and equipment from gold to base-metal mines.

Striking evidence of the rôle of gold mining as a non-essential industry was the order issued by the War Production Board on Oct. 8, 1942, which in principle suspended production in the United States and its possessions. Gold mines not producing substantial quantities of scarce metals were directed to cease breaking new ore within one week and to stop all but maintenance operations within 60 days. Certain small mines were permitted to continue at their existing level of production, and special exemptions were granted subsequently to cover outstanding hardship cases. The effect on gold output was not fully apparent in the statistics available by the year end, but production in November, as measured by receipts at United States mints and private refiners, amounted to only $7,500,000, one-third less than the average for the first ten months. Gold production in 1943 will be only a fraction of that in 1942. Even before the WPB order, the labor shortage and the Board's refusal to grant gold mines priorities on machinery and equipment had restricted output. Production in the first nine months in the United States, excluding the Philippines, had already declined more than one-fifth from that in the same period in 1941. In addition, receipts from the Philippines, of course, disappeared altogether last year.

The WPB order was aimed primarily at releasing skilled workers for the Western copper mines. The Board estimated that after allowing for maintenance crews, up to 4,000 men, including 1,000 miners and muckers, would be thus released. The War Manpower Commission attempted to place these men in the copper mines. Some transfers were no doubt made, but conditions tended to defeat the purpose.

No such drastic restriction has been undertaken in any foreign country, possibly excepting Russia. Few countries can afford so well as this one to forego the international purchasing power embodied in newly mined gold. Still, the need for such power among the United Nations has been greatly reduced by Lend Lease aid, Canadian free contributions to the United Kingdom, and British and Canadian credits to Russia. In fact, in no leading gold-mining country did the industry escape some restriction. In some countries, as in Canada, Australia, and—it may be stated with confidence though specific information is lacking—in Russia, gold production has been curtailed to free labor and materials for more essential work. In others, as in South Africa and Latin America, production has lagged because of rising costs and inability to get equipment.

In Canada, a government order issued in July prohibited the opening of new gold mines and limited the monthly tonnage in existing mines to the average of that in the first four months. In October, the Prime Minister stated that further curtailment was in prospect. Later, a program was initiated for transferring several thousand workers from the gold industry in Ontario to the nickel mines there. Production fell 10 percent behind that for 1941, and a more drastic decline may be expected in 1943.

Canada's failure fully to emulate the United States in closing down gold mines has been excused on the ground

that she, having thus far refused Lend-Lease aid, needs the newly mined metal to pay her bills here.

In South Africa, gold production fell off somewhat, owing largely to factors beyond South African control. The official policy there is to maintain output at the 1941 level, but this objective was not reached in 1942, because of rising costs and reluctance of the United States and the United Kingdom to allocate essential supplies and the shipping space to carry them. South Africa has been urged to give more recognition to the changed values in a warring world, and to divert manpower and materials to developing her manganese, chromite, and copper resources. A U. S. Government mission has visited the country to assist in this development, which aside from contributing to the United Nations' cause, would provide a broader base for South Africa's future economy and make it less vitally dependent on the future of gold. South African officials maintain that their production of strategic metals is not handicapped by absorption of their recources in the gold-mining industry. In any case, they declare, this industry is so vital to their economic life, and plays so important a rôle in providing revenue, that any significant restriction would handicap the Dominion's participation in the war. It is argued that the curtailment of gold mining under pressure from abroad would play into the hands of the anti-British elements in the country. It appears likely that by force of circumstances the gold output will continue to decline in greater or less degree for the duration.

The novelty of a fall in world gold production in 1942 was matched by a reversal in the trend of the United States' monetary gold stock. The Treasury's regularly reported holdings of about $22,700,000,000 actually declined by a few millions. Domestic gold produced continued to flow to the Treasury, but was exceeded by net sales of gold to foreign countries. This decline is to be attributed only incidentally to the fall in gold production. Primarily it was caused by fundamental changes in the structure of international trade and international payments. On the one hand, allied countries were drawing vast supplies from here as Lend-Lease aid rather than against payment in gold. On the other, European neutral countries and many Latin American republics were purchasing gold here with dollars which because of shipping shortages and United States export controls could not be spent on needed American goods.

The Lend-Lease Act was passed in March, 1941, primarily to assist the United Kingdom, whose gold stocks had by then been virtually exhausted. Once the Lend-Lease principle had been established, however, assistance under this Act was extended to allied countries. In short, over a wide range of the international transactions of the United States, Lend-Lease credits have assumed the rôle formerly played by gold imports. Total Lend-Lease aid exceeded $3,000,000,000 by the end of 1942; actual exports of Lend-Lease goods had reached nearly $5,000,000,000. To the extent that Lend-Lease credits are eventually to be repaid, they might be considered a deferred claim on foreign gold stocks; but official declarations in the United States have already made it clear that large-scale post-war cash repayment for Lend-Lease aid is not anticipated nor desired.

Analogous financial arrangements among the United Nations may have indirectly affected our receipts of foreign gold. Canada shipped vast supplies to the United Kingdom in 1941 and 1942, financed first by credit transactions and then by an outright gift of $1,000,000,000 to the mother country. Had she succeeded in exacting part payment in gold, much of this metal might have been sold by her to this country. Actually, Canada has continued to pay cash for supplies obtained here without British gold, as a result of close control over its purchases, large U. S. Government purchases in Canada designed to reinforce that country's exchange position, and a special arrangement whereby Lend-Lease assistance to the United Kingdom has been extended to cover goods supplied to Canada for British orders.

World Gold Production

Source: *Federal Reserve Bulletin*

(In millions of ounces)

Principal countries	1942 (*a*)	1941
North America	10.3	12.1
United States (including Philippines)	4.7 (*b*)	6.0
Canada	4.8	5.3
Mexico	0.8	0.8
South America	1.0	1.1
Colombia	0.6	0.7
Chile	0.2	0.3
Nicaragua	0.2	0.2
Africa	16.0	16.4
South Africa	14.1	14.4
Rhodesia	0.8	0.8
West Africa	0.8	0.9
Belgian Congo	0.3	0.3
Asia and Oceania	1.4	1.8
Australia	1.1	1.5
British India	0.3	0.3
Total, principal countries	28.6	31.4
Other countries (c)	5.0	5.4
World totals (c)	33.6	36.8
Percentage change	−8.8	+0.8

(a) Preliminary and partly estimated. (b) Assuming Philippine output unchanged at 1,150,000 oz. (c) Excluding Russia.

A measure of the extent to which certain foreign countries have been accumulating gold in the United States is given by the figures for gold under earmark for foreign account at the Federal Reserve Bank of New York, published as a single total. Gold under earmark increased $400,000,000 in 1941, and a further $450,000,000 in 1942, reaching an unprecedented total of nearly $2,700,000,000 at the end of last year. The bulk of the increases presumably represent purchases of gold here, rather than shipment of gold to the United States by foreign countries for safekeeping. The Latin American countries have financed their gold purchases largely from the dollar surpluses accruing from their trade with this country. These surpluses are a phenomenon arising from the demand here for Latin American strategic materials, and from the inability of this country to meet in full Latin American requirements for goods. After the war, this gold may be resold to the United States, but the fact that these countries —and European neutrals—choose to hold much of their foreign reserves in gold rather than in dollars is a testimonial to their faith in the metal's future.

One further factor limiting foreign sales of gold to the United States has been the German occupation of important gold-holding countries such as France, Belgium, and the Netherlands. Commercial and financial transactions between these countries and the United States have virtually ceased.

What then of the future of gold? What may be its rôle in the new monetary régimes which will grow up, or be constructed, after the war? Must the United States somehow "redistribute" its stocks to make this rôle effective? If gold does discharge a function in the new order, will there still be need for an annual accretion to the world's gold reserves from new production?

Specific answers can hardly be given, but certain guideposts to future policy are apparent. First, it is clear that gold will never again dominate domestic monetary policies as it has in many countries in the past. The tradition which demanded that central banks maintain gold reserves in fixed proportion to their outstanding notes and demand liabilities is fast becoming obsolete.

As to whether gold will continue to be accepted as an international medium of exchange, much depends upon the United States' gold-purchase policy. No country and no person will be reluctant to accept gold as long as there is one firm buyer in the market willing to bid for unlimited quantities at a fixed price; in recent years this firm buyer has been the U. S. Treasury. Should the United States qualify its willingness to buy all gold offered, the

position of the metal would be seriously compromised; should it refuse to buy gold, the metal might become just another commodity.

The fact that a sharp fall in the world market price for gold would reveal the arbitrary character of the monetary value attached to the gold stock of the United States is a great deterrent to any change in this country's gold-purchase policy. But to maintain the fiction that our gold hoard is "worth" $22,700,000,000, we may have to spend many more billions in acquiring foreign gold. The aggregate foreign holdings of monetary gold, excluding gold in Eastern hoards and in use in industry and the arts, amount to about $10,000,000,000. Over $1,000,000,000 of additional gold is produced annually by foreign countries, although the rate is declining. Thus substantial quantities can still flow here. Indeed, it is likely that they will do so after the war unless we succeed in striking a better balance in international trade than in the inter-war period. In short, if we do maintain our gold-purchase policy, the only way to avoid a fresh accumulation of foreign gold is to limit our exports or to expend our imports of goods and services. As a short-term solution, gold imports might be replaced by foreign loans, including stabilization fund credits and the like; but if these loans are ever to be repaid, a basic adjustment of the character described is inescapable. It should be noted that the export of capital to this country by foreigners would also necessitate sales of foreign gold here; in the interests of the United States as well as of foreign countries, international capital movements may be subjected to future control.

In any case, the substantial figures cited for foreign gold reserves and production serve to show that the United States need not "redistribute" its gold holdings to start the international payments machine moving again. The dollar value of foreign gold holdings is half again as large as in 1929.

On the assumption that it will prove desirable to maintain gold as an international medium of exchange after the war, the question of whether new gold production serves any economic purpose remains unresolved. A gold-producing country finds such production lucrative and a ready source of foreign exchange. On the other hand, the output of foreign mines increases the potential liability of the country supporting the gold market. Since the world as a whole has more than enough gold to carry on international clearing operations, it is not impossible that gold-buying countries will demand the restriction or eventual elimination of foreign gold production as the price of their continued support of the gold market.

SILVER

Year marked by great increase in industrial demand. Official New York price for foreign metal advanced to 44¾c. based on 45c. ceiling

Dickson H. Leavens *Cowles Commission for Economic Research*

THE YEAR 1942 saw the first material change in the price of silver since 1939. The United States Treasury price for newly minded domestic metal continued at 71.11c. per ounce, but the price of foreign silver was allowed to rise. The greatly increased industrial demand, already beginning to be felt in 1941, created competition for the limited supplies coming on the market. Handy & Harman's official price remained at 35⅛c. per ounce, 0.999 fine, during the first months of the year and was frozen by the General Maximum Price Regulation effective May 11. The ceiling was raised to 35⅜c. by Maximum Price Regulation No. 198, issued by the Office of Price Administration on Aug. 5, effective Aug. 10. Supplies, however, were inadequate, and Handy & Harman were forced to ration their customers. This led to private purchases in Mexico, reportedly as high as 65c. per ounce. On Aug. 22 the State Department announced that it had come to an agreement with Mexico to allow 45c. an ounce for silver from Aug. 31. On Aug. 30 the OPA authorized an increase in the maximum price of imported silver bullion (and of bullion domestically refined from imported ores and concentrates) to 45c. an ounce.

World's Silver Production

Excepting 1941 and 1942, which are E.&M.J. estimates, the figures in the following table on world production of silver are from the "Yearbook" of the American Bureau of Metal Statistics.

	(In Troy Ounces)
1933	169,680,081
1934	186,488,619
1935	214,534,290
1936	252,790,104
1937	275,645,045
1938	264,031,034
1939	257,918,749
1940	273,295,111
1941	(a) 272,000,000
1942	(a) 235,000,000

(a) Conjectural.

Handy & Harman followed suit and raised the official price to 44¾c. on Sept. 1. The OPA also authorized increases in the price of semi-fabricated silver, whether made from domestic silver at 71c. or from foreign silver at 45c., to match the increased cost of the raw material. Price ceilings on manufactured silver articles, however, were held at the levels based on the 35c. quotation.

The London and Bombay silver markets remained completely insulated from the New York market, and from each other, because of government restrictions on the movement of silver and on the supply of foreign exchange for transactions in it. The London price was steady at 23½d. per ounce, 0.925 fine (equivalent to about 43c. in New York), at which price the government of India was ready to sell. The Bombay price rose sharply in the spring and again in the autumn, partly because of war news but fundamentally because incomes, increased by wartime prices for Indian products, were turning to the traditional investment in precious metals. The price at the end of the year was in the neighborhood of 109 rupees per 100 tolas (1 tola = 180 grains) fine (equivalent to about 88c. in New York), the point at which the old rupee coins (1 tola in weight and 11/12 fine) were worth melting. Thus new rupees, 0.500 fine, coined since December, 1940, would not be worth melting unless the price reached 200 rupees per 100 tolas.

Production of silver in 1942 amounted (according to present estimates) to 235,000,000 fine ounces, a decrease of 37,000,000 oz. compared with the 272,000,000 oz. produced in 1941. United States production of 54,000,000 oz. may be compared with 64,800,000 oz. in 1941 and with the all-time peak of 71,000,000 oz. in 1937.

Little information is available about "other supplies" of silver. The government of India stopped sales in Bombay from its reserves early in the year, and resumed only for brief intervals. It was steadily increasing its stocks by rupee recoinage, but no official figures are available as to the quantity it had

on hand in London and in Bombay at the end of the year. Absorption of silver by the Indian public was reportedly as high as 50,000,000 oz.

The United States Treasury during the first half of the year purchased most of the newly mined domestic silver and a small quantity of foreign silver. Purchases of the former declined as some of it began to be taken by users willing to pay 71c., and purchases of the latter ceased after May, all foreign silver being diverted to industrial uses. Total purchases for the year were less than 65,000,000 oz., compared with 143,000,000 oz. in 1941 and much larger quantities in earlier years. Treasury stocks are shown in the accompanying table, which separates monetary silver from the so-called "free silver" in the general fund.

United States Treasury Stocks of Silver

	Quantity		Monetary Value	
	Dec. 31 1941	Dec. 31 1942	Dec. 31 1941	Dec. 31 1942
Silver dollars	Millions of Ounces		Millions of Dollars	
(chiefly in reserve)	423	423	$547	$547
Silver bullion (in reserve)	1,142	1,173	1,476	1,516
Subsidiary silver coins (a) (chiefly in circulation)	360	435	497	600
Total in monetary system	1,925	2,031	$2,520	$2,663
Silver bullion in General Fund at cost ("free silver") (b)	1,353	1,296	660	628
Potential signiorage thereon	.....	.....	1,089	1,047
Grand total silver at monetary value	3,278	3,327	$4,269	$4,338

(a) 1942 figures estimated from November 30 official figures.

(b) Of this, 587,000,000 oz. had been loaned to the Defense Plant Corporation.

Coinage of subsidiary silver coins during the year has been the greatest in the history of the country, amounting to about $100,000,000, compared with $72,000,000 in 1941 and with $54,000,000 in 1917 and 1918 together. The total stock at the end of the year was about $600,000,000 and the circulation amounted to over $4.25 per capita. Silver is also being used in the new 5c. coin.

An order of the War Production Board on March 2, denying priorities for machinery and supplies to mines the production of which more than 30 percent, in value, consisted of gold or silver or both, led to protests by silver producers. The Senate Special Silver Committee, originally appointed in August, 1935, but inactive since 1939, held hearings in Washington in May, and in Reno, Salt Lake City, Denver, and Washington in July, at which representatives of the mining interests and of the government were heard. As a result the WPB agreed to modify its order and to consider each case on its merits. It is perhaps significant of the influence of the silver bloc that the WPB did not include silver mining in its subsequent order of Oct. 8 stopping gold production. Reports of these hearings, published under the title "Silver" by the Government Printing Office as Parts 9 and 10 of the Committee's series (pp. 437-710 and 711-1044) contain extensive material on the mining industry, on industrial uses of silver, and on the silver question in general.

The shortage of copper led to the adoption of the plan originally proposed in 1941 of using silver for busbars in electrical plants, especially those supplying power for aluminum production. Secretary of the Treasury Morgenthau was advised that loans of the "free silver" for such purposes would be legal and he also secured the informal approval of the silver group in the Senate. In June the Treasury began to release silver to the Defense Plant Corporation, a subsidiary of the Reconstruction Finance Corporation. In December, Secretary Morgenthau announced that silver for coinage would be supplied to England and Australia, and to other countries if requested, on a Lend-Lease basis.

The demand for the white metal for consumptive purposes increased greatly because of the shortage of copper and tin. R. J. Lund, chief of the Miscellaneous Metals Division of the WPB, testifying before a subcommittee of the Senate Banking and Currency Committee on Oct. 14, estimated United States industrial consumption at 125,000,000 oz. in 1942 (Handy & Harman's estimate is 115,000,000 oz.) and 173,000,000 in 1943, compared with 44,000,000 in 1940 and 80,000,000 in 1941. The increases were chiefly for electrical uses, solders, brazing, alloys, and bearings, and only 2,000,000 oz. was estimated for silverware and the like in 1943, compared with a normal 30,000,000 oz. or more. Moreover, Mr. Lund reported that new uses for silver were constantly developing and that essential war needs might eventually take as much as 400,000,000 oz. a year.

This heavy industrial demand led to action by the WPB, whose Conservation Order M-199, issued July 29, restricted deliveries of foreign silver for the manufacture of civilian goods in August and September to one-half normal supplies and stopped all deliveries Oct. 1. Manufacturers of silverware and other non-essential products were therefore limited to the use of newly mined American silver at 71.11c.

To ease the situation for the manufacturers, many of whom were situated in his State, Senator Green, of Rhode Island, introduced a bill (S. 2768) to allow the sale by the Treasury of "free silver" and the loan for non-consumptive purposes (such as busbars) of silver from the certificate reserve. The price was to be not less than 50c. an ounce, the approximate average cost of the "free silver" (the average cost of all silver purchased since 1933 is somewhat higher—nearly 54c. per ounce). Hearings on this bill were held by a subcommittee of the Senate Banking and Currency Committee on Oct. 14 and Dec. 1. In September there seemed to be a real shortage of supplies, but in October the situation had eased somewhat; manufacturers of war supplies were not taking all the 45c. silver imported from Mexico (it could not be sold to manufacturers of civilian goods) and the Metals Reserve Co., a subsidiary of the Reconstruction Finance Corporation, purchased the surplus for a stockpile. Demand revived again in November.

Senator McCarran, of Nevada, was the leader of the opposition to the Green bill. He and other silver Senators professed to be willing to allow the sale of "free silver" at 71c. (which would be of no help to civilian manufacturers who could already purchase newly mined domestic silver at that price), but undoubtedly feared that the passage of the bill, even so amended, would undermine the structure of silver legislation erected in the last decade. Senator McCarran conducted a filibuster in the closing days of the Seventy-seventh Congress and thus prevented any action being taken on the bill. Its supporters, however, announced that they would bring the matter up again in 1943.

MINING IN WARTIME

UNITED STATES

Mining industry achieves the impossible in production. Gold properties shut down and Western labor is frozen to remedy the shortages due to war industry competition. Morenci project begins operation

Evan Just *Assistant Editor*

As IN VIRTUALLY all domestic industry, the dominant factor in American mining throughout 1942 was the profound effect of the war. The tremendous demands of the war program for raw materials required maximum production from sources already in production and the hasty development of deposits too remote or too low in grade to be economically operated. Beset by these expanding needs on the one hand, and increased difficulty in getting equipment and supplies on the other, the mining industry was called on for a supreme effort. This it made, with conspicuous success, despite the enormity of the task, dilution of its technical skill, mounting wages, labor shortages, and considerable difficulty in obtaining its material needs.

MINE PRIORITIES—To conserve manpower and materials, restrictions were continued on the development and purchase of new equipment. On the whole, established operations were expected to get along with what they had. High preference ratings were granted for mine maintenance and repair under Preference Rating Order P-56, and these ratings were advanced to keep pace with a gradual inflation of ratings as the year passed. The War Production Board, which succeeded the Office of Production Management early in the year, was unable to control the issuance of more high ratings than could be met with available supplies, so that ratings for essential industries had to be advanced in order to keep them in operation.

RFC ACTIVITIES—The demand for minerals required development of many deposits that could scarcely be classed as good business risks, because of the probability that after the war they would be unprofitable to operate. To meet this situation, the Reconstruction Finance Corp., launched a vast program* of providing money for mine development and plant rehabilitation and construction. Three classes of loan were available to domestic mine, mill, and smelter operators—General Mining Loans, Development Loans, and Preliminary Development Loans.**

Also, through its subsidiary, Metals Reserve Co., RFC made extensive purchases of and purchase contracts for mineral supplies. Many of these purchases and contracts involved prices higher than those of the current market. To facilitate strategic-mineral production by small operators, Metals Reserve also established a number of purchasing depots in various sections of the country, where small lots could be delivered for cash payment.

Through another subsidiary, Defense Plant Corp., the RFC financed the construction of a number of new plants, including several metallurgical plants. It was the policy of the RFC to have such plants built by private contractors, and then to lease them to private parties for operation. This harmonious relationship with private industry afforded speed and efficiency which could not have been duplicated in any other way, and pointed up a policy which some other branches of government could have imitated to advantage.

PREMIUM QUOTA PLAN—Despite the greatly expanded requirements for minerals, they were included with nearly all other commodities in the orders issued by the Office of Price Administration freezing prices at ordinary levels. This action would have limited the productive capacity of the mining industry, considering its rising costs, had it not been for the activities of the RFC and the Premium-Quota Plan. This plan, which applied solely to domestic production of copper, lead, and zinc, was in the form of a guarantee that Metals Reserve Co., would pay the mine operator premiums for his production in excess of an arbitrary quota. The guarantee was projected to last 2½ years from Feb. 1, 1942, and was extended in January, 1943, for another year. During the year, premiums were 5c. per pound of recoverable copper, 2¾c. per pound of lead, and 2¾c. per pound of zinc. The plan did not undertake to guarantee market prices. It embraced a fair basis, optional with Metals Reserve, for cash settlement in case of the war's end. At first, quotas were generally equivalent to average monthly production for 1941, but were gradually altered where necessary to keep unprofitable operations in production. By late 1942 it became evident that important increases in prices or premiums would be required if the sections of the industry affected were to be expected to bear the enormous load placed upon them for the duration of the war, as the premium levels established had not been sufficiently high to spur the establishment of new ore reserves to offset depletion, nor to finance the mining of the low-grade ores that would have to be used.

TAX RELIEF—One of the most heartening events of the year to the mining industry was the treatment accorded it in the 1942 Revenue Act. Although the law raised taxes to the highest levels in the nation's history, the need for encouragement to mining was sufficiently obvious to impel Congress to liberalize the tax code with respect to mines, despite vigorous opposition from the Treasury. Percentage depletion, the principle objective of the Administration attack, was retained, and metal mines were given the privilege which had been available to oil producers since the initiation of percentage depletion, an annual choice of percentage or cost depletion. Previously, an election once made was binding for the life of the property. Congress also recorded its displeasure at the "chiseling" tactics which had been pursued by the Treasury in computing depletion allowances on certain mine products, such as mercury. Restoration of the exemptions from excess profits taxation for producers of strategic minerals that had been offered in the 1940 law and revoked in 1941 repaired a breach of faith with those producers who had counted on the exemption when making their investments. Congress further adopted a principle of excess profit taxation of mine income which computed excess profits per unit of production rather than on total income. This principle in effect recognized that profits consequent upon accelerated depletion of mineral deposits are not excess profits.

MINING MANPOWER—Competition for manpower resulted in a distressing labor shortage for Western mines, beginning about mid-year. The sparsely populated Western states were the scene of important new in-

* See *E.&M.J.*, December, 1942, p. 84.

** See *E.&M.J.*, January, 1943, p. 62.

dustrial activities, particularly in the Pacific Coast states, including a number of shipyards and airplane factories. The manning of these plants, plus the construction of a number of cantonments built for the Army and Navy on a cost-plus basis, imposed such a severe drain upon the manpower of the region that many mines were reduced to half a normal working force. As a result, production was curtailed, although it did not suffer as much as development work, which lagged to an extent that will complicate future problems of production. The mine situation became serious enough in late summer and early autumn to loom up in the press as the primary manpower difficulty in the nation, which position it later shared with agriculture. In September the War Manpower Commission issued a directive freezing the remaining manpower in the mines and forbidding the recruitment of mine labor by contractors doing government work. This action helped a good deal toward stemming the drainage of manpower away from the mines, even though it did little to augment the mine labor supply. By November the situation had been recognized by the Army as serious enough to warrant the release of 4 000 drafted miners from military service, with the provision that they must stay at work in essential mines or be forced back into military training. This move gave considerable relief to Western metal mines, despite the fact that most of the men released had had only coal mining experience. By the end of the year the mine labor shortage was decidedly less acute, although the mines were still far from a comfortable position as to labor supply.

Also on the labor front, in August the War Labor Board held group hearings on a number of mining industry cases which had been certified to it by Labor Secretary Perkins as "deadlocked disputes". The decision affording a dollar per day increase in wages was no surprise to anybody, it having been evident from the utterances of officials prior to and during the hearings that the government intended to grant the labor organization substantially what it sought.

SURVEY AND BUREAU ACTIVITY—The U. S. Geological Survey and U. S. Bureau of Mines played an active part in mineral development for war purposes by entering into the search for critical minerals, determination of the extent and worth of deposits not ordinarily exploitable at a profit, and research into metallurgical processes with a view to handling lower grades of raw material in case a long war or lack of shipping facilities should require recourse to such sources of supply.

PRODUCTION RECORDS—According to the U. S. Bureau of Mines, the value of domestic mineral production reached a record high in 1942, including $2,330,000,000 worth of metallic products and $1,135,000,000 worth of non-metallic products, exclusive of mineral fuels. This included the highest production levels in our history for aluminum, magnesium, iron ore, copper, chromium, molybdenum, tungsten, vanadium, cadmium, barite, fluorspar, potash, phosphate rock, high-grade clays, and slab zinc.

IRON ORE—To meet the tremendous demand for iron and steel, the War Production Board set up a quota of 90,000,000 tons of ore to be shipped down the Lakes during the 1942 season. When the "E. W. Pargny" closed the season, this quota was exceeded by nearly 3,000,000 tons. All active Lake Superior mines were pushed to capacity and many mines were opened or rehabilitated on all the ranges. Most of the new mines did not make a large contribution to 1942 production, but will be important factors in an increased quota for 1943. Among the properties being revived is the Mountain Iron mine, the first mine to be opened on the great Mesabi Range, which produced three-fourths of the 1942 production. The famous Chandler mine, on the Vermilion Range, was abandoned late in the year. Work was commenced on increasing the capacity of alternative shipping routes so that greater flexibility and capacity could be obtained, as well as a longer shipping season.

In the autumn the National Lead Co. started production of titanium and magnetite sinter from a new mine and mill near Newcomb, N. Y. In the same region, at Fisher Hill and Newton Falls, Republic Steel and Jones & Laughlin Steel were developing new magnetite orebodies.

Preliminary work was done in opening an iron deposit near McKenzie Pass, in the Cascade Mountains of Oregon, said to contain 100,000,000 tons of ore. Preparations were also made to mine the abundant but scattered iron ores of east Texas.

COPPER, LEAD AND ZINC—Despite the circumstance that the United Nation's copper supply exceeded the entire world production in 1940, copper procurement continued to be one of the most serious war supply problems. The great copper camps of the West poured out a record production, in spite of labor shortages. In Arizona two important new mines were opened, the large, low-grade porphyry orebody of Phelps Dodge Corp. at Morenci, and the property of the new Bagdad Copper Corp. at Hillside. The first of these properties, a large open pit, electrified and with track haulage, was equipped to mine, mill, and smelt 25,000 ore tons per day. This development was barely in operation when an agreement was reached with Defense Plant Corp. to enlarge it to 45,000 tons per day capacity. The second, an underground mine and 2500-ton concentrator, which commenced operations in December, was financed with a $2,500,000 RFC loan. A 70-mile power line was built from Parker Dam, on the Colorado River.

Late in the year announcement was made of the discovery of very extensive, low-grade but probably workable copper deposits in northeastern Arizona and adjacent New Mexico.

Throughout the West, under the stimulus of the premium-quota plan, considerable activity occurred in the mining of copper, lead, and zinc. Some of the most important new developments were: opening of a new zinc-lead orebody by U. S. Smelting, Refining & Mining Co. and construction of a 250-ton mill at Bayard, N. M.; a considerable revival of base-metal mining in Colorado, including enlargement of the Shenandoah-Dives operation and rehabilitation of the old Highland Mary mine, at Silverton; construction of a new 100-ton mill at Ouray by the Denver Equipment Co. with concomitant revival of lead-zinc-silver mines in the Ouray district, and construction of a 1,000-ton sink-float plant by the Ore & Chemical Co. at Leadville for reworking dump ore and for possible use if Leadville operators are successful in promoting a large drainage tunnel to make ores available at deeper levels than those mined in the past. The Golden Cycle Corp., facing the shutdown of its Colorado Springs plant under the gold order, made plans to convert the mill in part to finish the rough sink-float concentrate from Leadville, and to handle base-metal ores from small mines of the region. Preliminary work was done toward reopening the Goodsprings district, in southern Nevada, and providing a Waelz plant to treat the oxidized zinc ores.

In the Tri-State district, strong efforts were able to keep concentrate production from declining materially during 1942, although the grade of ore dropped from 5.5 to 4.5 percent combined zinc and lead concentrate yield. The principal new operations were: the 50-tons per hour Jasper mill of Kansas Explorations, Inc., just west of Joplin; the 250-ton mill of the Northside Mining Co. at Chitwood; the Chitwood tailings re-treatment mill of the Missouri Mining Co.; movement of the Muncie mill of Federal Mining & Smelting Co. to Duenweg, east of Joplin; dewatering of the Paxson mine and nearby properties preparatory to reopening the 100-tons

per hour Paxson mill by Eagle-Picher Mining & Smelting Co. as agents of Metals Reserve; rehabilitation of the 50-tons per hour Beck mill on the outskirts of Baxter Springs to treat custom ore from nearby mines; and enlargement and conversion of the Evans-Wallower No. 4 mill, near Picher, to a tailings re-treatment plant. This district will have a struggle to maintain its unfillable place in the national zinc production picture for the duration of the war and will not be able to do so at the levels of prices and premiums which prevailed during 1942.

During the year substantial additions were made to zinc reduction capacity both by the construction of new plant and further rehabilitation of old installations.

FERRO-ALLOY METALS—A large increase was obtained in production of the strategic ferro-alloy metals. With respect to manganese, considerable imports continued, but a program was laid out to enable sufficient domestic production to supply the country's enlarged steel program for several years if necessary, even if imports from all sources except Cuba should be cut off. This program would include contributions from the principal actively producing areas, Montana, Arkansas, the Olympic peninsula of Washington, and scattered small deposits in the southeastern states, plus new projects on deposits held in reserve, in Nevada, Arizona, Minnesota, newly realized deposits in Maine, and, largest of all, a great tonnage of low-grade manganiferous nodules contained in South Dakota shales. Construction of a leaching plant was begun in Nevada. Activity in regard to the other undeveloped areas was confined to pilot-plant operations, to make sure that no practical difficulties would arise should full-scale operations become necessary. On the Olympic peninsula, the Sunshine Mining Co. started production from its Crescent mine. In Cuba, the Cuban-American Manganese Co., a Freeport Sulphur affiliate, carried on expanded operations. Preliminary work was done on a new discovery in the Bear Lodge Mountains of Wyoming.

With respect to chrome, a large increase in production occurred in the Sierra Nevada. Most of these operations were open pits. A new area was opened up in Montana, mining being undertaken by the Anaconda Copper Mining Co. Discoveries were made in the Chugach Mountains and Kenai Peninsula, Alaska, and arrangements have been made to mill the ores in the Alaska Juneau concentrator. A new discovery was also made on Casper Mountain, Wyoming. The Krome Corp. began construction of a 1,000-ton mill to concentrate chromite from beach sands on the Oregon coast, and preliminary operations were conducted by the Humphreys Gold Corp. to undertake a similar project. Approximately the same situation prevailed in chrome as in manganese—an adequate supply program was laid out to furnish the needs of the war program for several years, even with a cessation of imports, which, however, continued to arrive in fair volume.

Despite the fact that commerce was not cut off from Peru, the increased demands for vanadium were insufficient to require a considerable expansion of domestic production. With the assistance of government funds, both the U. S. Vanadium Corp. and Vanadium Corp. of America built new treatment plants, to handle increased ore tonnages brought out in the large area of vanadium-uranium bearing rocks in Colorado and Utah. Some new vanadium development also took place in Nevada. The Anaconda Copper Mining Co. was successful in extracting a considerable amount as a byproduct of treating phosphate rock from Idaho. The Wyodak Coal & Manufacturing Co., a Homestake subsidiary, undertook development of a vanadium prospect discovered during the year in western Wyoming.

A revolutionary increase occurred with respect to tungsten, the principal source of which was cut off when the Japs stopped transportation on the Burma Road. The principal domestic source was near Boulder, Colo., which responded with a notable production increase. But the startling feature of tungsten production was a host of discoveries of scheelite in all the Western mining states and in Canada, principally in gold-quartz veins. These discoveries were made in many cases where mining had gone on for many years or where apparently barren quartz veins had been passed up as valueless, and were made possible by the new violet ray technique. Portable violet ray lamps are now in common use by prospectors.

To exploit this new source of wealth, many mining operations altered their mill flowsheets to recover scheelite. In many locations the mineral was present in sufficient quantities to be minable on its own account or to warrant the reworking of dumps. In a few cases, workable deposits of placer scheelite were found. The principal scheelite-producing areas were Inyo and Kern counties, Calif., where some scheelite-bearing veins have been known for several years. One of the most important scheelite finds was at the Cupric mine, in Utah.

The great demand for nickel for armor plate caused a shortage of supply of that metal, even though the United States had access to the principal source of world production, at Sudbury, Ont. To bolster the nickel supply, Defense Plant Corp. financed the Nicaro Nickel Corp., operated by Freeport Sulphur, in the construction of a $20,000,000 plant in Cuba, to handle ores taken from scattered, shallow pits in that area.

The expansion in copper output led to an increase in molybdenum production, as most of the porphyry copper operations produce byproduct molybdenum. The Climax Molybdenum Co., principal producer, expanded the capacity of its great mine in Colorado to 15,000 tons of ore per day. In addition, the Reconstruction Finance Corp. financed rehabilitation of an old Colorado producer, the Urad mine. This $750,000 project was still under development at the end of the year.

An enormous expansion took place in the productive capacity for the light metals, aluminum and magnesium, 1942. In most operations involving these metals, mining of the ores is from shallow open pits, thus the principal expenditures were for metallurgical plants. In the production of magnesium, eight large reduction plants were financed by Defense Plant Corp., five of which were completed, including the gigantic Basic Magnesium, Inc., plant in Nevada, operation of which was taken over by Anaconda Copper, late in the year.

In respect to aluminum, capacity was raised to unheard-of figures durin the year, with parallel expansions of domestic mine production, principally in Arkansas and Georgia, and of Bayer process plants. One of the new plants was designed for direct reduction of alumina from bauxite, without purification. At the end of the year a new plant in Utah was ready for operation, capable of producing 100 tons per day of metal, using the alunite deposits of Utah as raw material. This plant, operated by Kalunite, Inc., was financed with RFC funds.

SILVER AND GOLD—Both silver and gold found themselves in paradoxical situations during 1942. At the beginning of the year, silver was rated as non-essential; thus, mines producing silver exclusively were denied priority serial numbers and faced difficulties in obtaining necessary supplies. As the year wore on, the use of silver in war industries became of sufficient importance to require government control over distribution, and considerable bitter agitation by silversmiths for repeal of the Silver Purchase Act developed. The latter move was successfully resisted, and domestically mined silver continued to flow principally into the

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CANADA

Output of minerals in Dominion is higher in 1942 than ever before. Country becomes self-sufficient in those of strategic character, formerly imported. Plans for greatly expanded iron production next year

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PRELIMINARY ESTIMATES show that Canadian mines in 1942 topped all previous records with production valued at $564,200,000, exceeding 1941 by $3,958,791, or 0.7 percent. Though gold output dropped 9.6 percent, to $185,947,877, this figure nevertheless represents 47 percent of the value of all metals recovered and 33 percent of Canada's total mineral production. Base-metal companies expanded operations to the point where the lower value of bullion was almost equalized and the value of all metallics was down less than 1 percent. Nonmetallics and fuels increased 5 and 6 percent, respectively, and structural materials declined 0.8 percent.

It is significant that a 75 percent increase was registered in the value of strategic minerals of which Canada is in critical need in time of war. These include antimony, bismuth, cadmium, chromite, cobalt, magnesium, molybdenite, tin, tungsten, and manganese having a total value of $4,177,813. The combined value of nickel, copper, zinc, and lead increased 0.9 percent, to $167,512,444. Another group of strategics (arsenic, iron ore, mercury, radium, uranium, and selenium) was up 50 percent to a value of $6,948,406, and the higher value of critically needed asbestos, fluorspar, mica, strontium, gypsum, quartz, salt, sodium sulphate, and other non-metallics also marked a vital contribution to the war effort of the United Nations.

As a result of development work and new discoveries in the past year, Canada is becoming self-sufficient in the following minerals that were formerly imported: barytes, chromite, magnesium, mercury, graphite, mica, molybdenite, sulphur, and tungsten. Each one of these affords material for an interesting chapter in the history of Canadian mining and testifies to the patriotic eagerness of private enterprise to direct effort to those channels that contribute directly to the fabrication of war supplies. Tin and other smelter byproducts continue to be recovered in growing quantity and, perhaps, in this category belong the rare metals of the platinum group that are produced by International Nickel in larger amount than anywhere else in the world.

Though the larger operating organizations have formerly displayed enterprise in the field of metallurgy and in the solution of mining problems, they have taken a leading part in the last two years in financing and giving engineering direction to large-scale field exploration. Noranda, Consolidated Mining & Smelting, Hudson Bay Mining & Smelting, and many small prospecting syndicates have sent parties into the bush. At the same time, Dome, Hollinger, Ventures, Ltd., Siscoe, San Antonio, Inspiration Mining, and other companies income of which has been derived entirely or in large part from successful gold production, have also taken a leading part in searching for minerals required for war purposes but which, once they are discovered, give limited promise of profitable exploitation.

Production is planned for early 1943 of the recently found, extensive chromite deposits in central Manitoba and molybdenite deposits east of Noranda in northwestern Quebec. The Black Lake chromite of southern Quebec was to be in production soon after the end of 1942, as was the Josephine iron mine, in the Michipicoten area of western Ontario. There are approximately 21 scheelite concentrators across the Dominion with capacities ranging from 10 to 100 tons a day, either operating or under construction. These mills, for the most part, treat material that is a byproduct of gold mining. Arsenic, in sufficient quantity to supply Dominion requirements and for export to the United States and Great Britain, is being recovered by Beattie Gold Mines and O'Brien Gold Mines in Quebec and by several Ontario and British Columbia gold operators.

A major issue, in the closing month 1942, was the sponsorship by Cyrus T. Eaton and Otis & Co., of a program for opening the large high-grade hematite deposits 140 miles west of Port Arthur, in western Ontario. Production of 2,000,000 tons annually from 1945 on, an initial output of one-fourth that amount in 1944, would be made possible by an expenditure of about $12,000,000. Funds would be provided from various sources, according to recent official announcements. The capital investment required for the Steep Rock project will make it rank with the seven or eight largest mining enterprises of the Dominion.

The mining industry has been involved in the nation-wide process of

Table I—Cumulative Dividend Record of Canadian Metal Mines (*a*)

Province and District	1939	1940	1941	1942	Total to End of 1942
ONTARIO					
Sudbury (*b*)	$32,091,513	$31,340,556	$31,757,739	$31,590,863	$388,577,159
Porcupine	14,254,781	15,696,296	16,502,243	12,028,518	216,433,587
Kirkland Lake (*d*)	15,940,989	13,923,096	14,144,989	9,385,023	190,708,401
Cobalt (*c*)	180,000	180,000	180,000	120,000	107,822,442
Patricia	3,628,503	4,977,457	4,785,974	3,759,028	25,544,962
Matachewan (*e*)	31,682	100,282	63,364	63,364	258,692
Michipicoten (*f*)	.....	.....	64,200	.....	64,200
QUEBEC	$13,901,065	$15,617,831	$16,017,471	$14,841,521	$113,264,090
BRITISH COLUMBIA (*b*)	13,227,279	14,226,598	16,108,786	13,965,717	249,847,701
MANITOBA	5,852,397	6,882,721	6,663,132	6,581,992	42,407,836
YUKON (*h*)	.....	422,597	547,694	.....	970,291
YELLOWKNIFE					
N. W. T. (*i*)	.....	.....	149,775	99,850	249,625
NOVA SCOTIA (*g*)	.....	29,496	.....	.....	77,424
MISCELLANEOUS (*j*)	1,168,708	1,329,863	1,576,218	2,373,505	11,273,472
Totals	$100,276,917	$104,726,793	$108,561,585	$94,809,381	$1,347,499,882

(*a*) Revised to Dec. 8, 1942, based on data from *Northern Miner*. (*b*) Payments in U. S. funds made by International Nickel, Howe Sound, and Granby Consolidated. (*c*) Since 1933, represents payments by Nipissing Mines, a holding company. (*d*) Includes three Larder Lake producers. (*e*) Young-Davidson Mines. (*f*) Cline Lake Gold Mines. (*g*) Dividend record incomplete. (*h*) Yukon Consolidated. (*i*) Negus Mines. (*j*) Includes ten holding companies and, in 1942, capital distribution of $713,450 from three dismantled gold mines.

Table II—Canadian Metal Mines Producing in 1942

Mining Company	Gold Recovery per Ton 1942	Working Costs per Ton 1942 (1)	Daily Tonnage 1942	Mill Capacity 1942	Date of First Production
ONTARIO					
Aunor Mines (*h*)	$10.58	$5.65	450	500	Jan. 1940
Bankfield Cons. Gold	6.48	7.23	(1)	145	May 1937
Berens River Mines (*ii*)	16.39	.....	225	255	Sept. 1939
Bidgood Kirkland Gold	10.45	8.64	136	160	July 1934
Bonetal Gold Mines	5.89	5.02	113	.....	Nov. 1941
Broulan Porcupine Mines	7.00	3.60	372	425	Nov. 1939
Buffalo Ankerite Gold Mine	6.15	4.54	850	1,300	June 1926
Central Patricia Gold Mines	12.02	6.90	420	425	June 1934
Chesterville Larder Lake	6.96	3.17	600	1,200	July 1939
Cline Lake Gold Mines	5.31	4.83	(1)	50	July 1938
Cochenor-Willans Gold Mines	21.25	10.70	184	200	Dec. 1939
Coniaurum Mines (*j*)	9.84	6.02	525	600	May 1928
Delnite Mines (Sylvanite)	7.10	4.96	476	525	June 1937
DeSantis Porcupine Mines	7.30	4.32	(2)	180	May 1939
Dome Mines	11.69	4.38	1,400	1,800	1910
Faymar Porcupine Mines	9.32	.....	(3)	250	Mar. 1940
Golden Gate Mining Co	9.16	.....	(4)	150	May 1938
Hallnor Mines (*h*)	16.81	5.11	350	400	June 1938
Hard Rock Gold Mines	8.68	6.00	425	450	Jan. 1937
Hasaga Gold Mines	8.00	4.14	350	500	Sept. 1936
Hollinger Cons. Gold Mines	9.88	5.21	3,500	5,200	1910
Hoyle Gold Mines	4.74	3.78	550	700	Feb. 1941
Jason Gold Mines (Argosy)	15.75	9 39	(5)	150	June 1940
Jerome Gold Mines	6.65	3.75	490	500	Aug. 1941
Kerr Addison Gold Mines	8.09	4.00	1,904	2,200	May 1938
Kirkland Lake Gold Mines	14.19	7.29	250	450	1919
Lake Shore Mines	14.98	7.48	1,000	2,500	1918
Leitch Gold Mines	31.81	13.86	84	115	Jan. 1937
Little Long Lac Gold Mines	13.81	7.68	338	350	Dec. 1934
Macassa Mines (*l*)	17.50	6 72	345	450	Oct. 1933
MacLeod-Cockshutt Gold Mines	11.26	5.63	682	1,000	Apr. 1938
Madsen Red Lake Gold Mines	9.64	5.28	400	410	Aug. 1938
Magnet Cons. Gold Mines (*i*)	20.74	.....	130	160	July 1939
Matachewan Cons. Mines (*j*)	3.09	.....	880	1,000	Nov. 1934
McKenzie Red Lake Gold Mines	11.64	6.77	240	250	Mar. 1935
McIntyre Porcupine Mines	10.58	5.61	2,000	2,550	1912
McMarmac Red Lake Gold Mines	15.93	8.15	90	100	Oct. 1940
Moneta Porcupine Mines	17.24	7.38	175	200	Jan. 1938
Naybob Gold Mines (Hayden)	10.41	5.64	100	225	1939
Omega Gold Mines	5.16	4.31	490	525	1936
Pamour Gold Mines (*h*)	4.00	3.00	1,400	1,700	May 1936
Paymaster Cons. Mines	8.46	6.64	570	600	Oct. 1934
Pickle Crow Gold Mines	18.09	7.04	418	450	Apr. 1935
Preston East Dome Gold Mines	9.30	5 50	840	1,100	Mar. 1939
Ross Mine (Hollinger)	10.36	6.02	150	300	Jan. 1936
Sand River Gold Mining Co	10.81	9.75	(5)	110	Dec. 1937
St. Anthony Gold Mines	4.28	3.50	(3)	200	Aug. 1927
Sturgeon River Gold Mines	25.44	11.37	(1)	85	Apr. 1937
Sylvanite Gold Mines	13.13	6.38	540	600	July 1927
Teck-Hughes Gold Mines	12.94	6.95	268	1,300	1917
Toburn Gold Mines (*i. c*)	17.54	15.46	114	180	1913
Tombill Gold Mines (*ii*)	10.16	5.76	140	150	Feb. 1938
Tyranite Mines (Sylvanite)	5.62	4.18	(6)	250	June 1939
Uchi Gold Mines	4.95	4.18	400	750	May 1939
Upper Canada Gold Mines	16.51	7.87	210	400	Nov. 1938
Upper Seine Gold Mines	4.86	.....	(6)	100	Nov. 1940
Wendigo Gold Mines	12.91	10.18	(7)	110	Jan. 1936
Wright-Hargreaves Mines	19.80	7.34	700	1,250	1912
Yama Gold Mines	.....	.....	50	75	Oct. 1941
Young-Davidson Mines (*z, g*)	4.41	3.43	800	1,100	Sept. 1934
Algoma Ore Properties (siderite)	.....	.....	.....	2,000	July 1939
Dominion Magnesium	.....	.....	.....	10	July 1942
Falconbridge Nickel Mines (*j, zz*)	.....	.....	1,500	2,300	Feb. 1930
International Nickel Co. (*pp*)	.....	.....	32,000	35,000	1916
Josephine Iron Mines (*j*)	.....	.....	.....	.....	Dec. 1942
Lake Geneva Mining Co. (*p*)	.....	.....	.....	100	Aug. 1941
Zenith Molybdenum Corp	.....	.....	.....	100	Oct. 1942
QUEBEC					
Arntfield Gold Mines	3.86	3.39	(3)	300	Aug. 1935
Beattie (Quebec) Gold Mines (*j*)	4.32	2.40	1,881	1,900	May 1935
Belleterre Mines (McIntyre)	12.94	6.28	361	375	Aug. 1936
Canadian Malartic Gold (*j*)	4.04	2.64	990	1,000	May 1935
Central Cadillac Mines (*xx*)	5.84	.....	250	300	Nov. 1939
Cournor Mining Co	6.09	4.00	(6)	200	Sept. 1937
East Malartic Mines	5.30	3.31	1,140	1,600	Nov. 1938
Francoeur Gold Mines	5.94	4.25	174	400	July 1938
Lamaque Mining Co. (Teck-Hughes)	11.61	4.06	925	1,300	Apr. 1935
Lapa Cadillac Gold Mines	7.23	5.28	36	300	July 1938
Noranda Mines (*ww*)	3.94	.....	.....	7,000	Dec. 1927
Malartic Gold Fields	8.32	5.09	614	1,000	Dec. 1939
Mic-Mac Mines (*a, i*)	.....	.....	.....	500	June 1942
McWatters Gold Mines	7.60	6.69	119	150	Sept. 1934
O'Brien Gold Mines	14.38	8.87	190	200	Sept. 1934
Pandora Cadillac Gold Mines	5.86	5.37	(5)	175	Sept. 1940
Perron Gold Mines	12.20	7.51	390	425	Apr 1934
Powel Rouyn Gold Mines (*n*)	4.26	3.40	937	450	1937
Senator-Rouyn	9.34	5.37	281	300	Oct. 1940
Sigma Mines (Dome)	7.56	4.44	1,095	1,100	Mar. 1937
Siscoe Gold Mines	4.94	3.22	990	1,000	Jan. 1929
Sladen-Malartic Mines	4.55	2.90	600	750	Jan. 1938
Stadacona Rouyn Mines (*v*)	5.04	4.18	450	500	Nov. 1936
Sullivan Consolidated Mines	10.11	7.84	382	500	May 1934
Wood Cadillac Mines	6.39	.....	(8)	250	Dec. 1939
West Malartic Mines	.....	.....	.....	300	May 1942
Aldermac Copper Corp. (*d, qq*)	.....	.....	.....	1,200	Jan. 1937
Chromite, Ltd	.....	.....	.....	50	Dec. 1941
Golden Manitou Mines (*u*)	9.32	4.00	600	600	July 1942
New Calumet Mines (*j, p*)	.....	.....	.....	300	Dec. 1942
Normeta Mining Corp. (*e, jj*)	.....	4.13	775	800	Sept. 1937
Quyon Molbdenite Co	.....	.....	.....	150	Oct. 1941
Tetreault Mine (*p, cc*)	.....	.....	.....	200	June 1942
Molybdenite Reduction Co (*cc*)	.....	.....	.....	150	Nov. 1942
Waite Amulet Mines (*f h. vv*)	.....	.....	1,500	1,500	June 1937

Mining Company	Gold Recovery per Ton 1942	Working Costs per Ton 1942 (1)	Daily Tonnage 1942	Mill Capacity 1942	Date of First Production
MANITOBA					
God's Lake Gold Mines	11.60	6.46	200	225	Sept. 1935
Gunnar Gold Mines	11.36	9.46	(4)	150	Aug. 1936
San Antonio Gold Mines	11.37	4.65	340	550	July 1932
Hudson Bay Min. & Smelt. (*dd*)	.....	.....	.....	6,200	Sept. 1930
Sherritt Gordon Mines (*f, j*)	.....	.....	.....	2,125	Aug. 1937
NOVA SCOTIA					
Avon Gold Mines (Oldham	11.43	10.40	10	100	May 1936
Guysboro Mines (*j*)	6.33	5.75	(9)	100	1934
SASKATCHEWAN					
Box Mine (*r*)	2.00	1.50	(2)	1,500	July 1939
NORTHWEST TERRITORIES					
Con Mine (*r, ee*)	28.70	.....	180	380	Sept. 1938
Eldorado Gold Mines (*o*)	.....	.....	100	100	1933
Negus Mines	30.29	16.93	67	80	Feb. 1939
International Tungsten (*aa*)	26.16	.....	40	50	Oct. 1941
Ptarmigan Mines (*r*)	.....	.....	(1)	100	Dec. 1941
Ruth Mines (*r*)	.....	.....	(1)	100	1942
Thompson-Lundmark Gold Mines (*r*)	34.94	17.29	78	100	Aug. 1941
BRITISH COLUMBIA					
Alpine Gold Mines	.....	.....	(4)	50	1941
Bayonne Consolidated Mines	15.72	12.74	(5)	65	Apr. 1940
Bralorne Mines (*q*)	20.04	7.18	544	550	Feb. 1932
Buena Vista Mining Co. (*p*)	2.60	2.26	(3)	750	Apr. 1938
Cariboo Gold Quartz Mines	15.21	8.34	173	400	Jan. 1933
Central Zeballos Gold Mines	.....	.....	(6)	50	Jan. 1940
Consolidated Nicola Goldfields	.....	.....	.....	150	May 1942
Florence Mining Co. (*p*)	.....	.....	.....	150	Mar. 1943
Gold Belt Mining Co	13.77	8.07	160	165	Oct. 1938
Emerald Lake Tungsten	.....	.....	.....	100	Oct. 1942
Hedley Mascot Gold Mines (*a, c, t*)	13.09	9.46	198	250	May 1936
Highland Surprise Mining	.....	.....	(3)	75	1940
Island Mountain Mines (*ii*)	16.88	9.14	130	160	Nov. 1934
Kelowna Exploration Co. (*s, ee*)	.....	.....	.....	275	1934
Kootenay Belle Gold Mines (*b, u, ee*)	12.69	10.98	100	120	Dec. 1934
Mt. Zeballos Gold Mines (*ee*)	17.85	10.19	(4)	65	Aug. 1939
Musketeer Mines	.....	.....	(6)	25	1942
Pioneer Gold Mines of B. C	18.10	7.63	315	400	1928
Polaris-Taku Mining Co. (*ee*)	12.00	.....	(4)	300	1938
Privateer Mines	33.70	14.51	48	100	Oct. 1938
Sheep Creek Gold Mines (*a*)	16.38	6.25	(3)	175	May 1935
Silbak-Premier Mines (*i, m*)	8.56	5.30	314	600	1919
Spud Valley Gold Mines (*ee*)	12.43	.....	(3)	110	Nov. 1938
Surf Inlet Consolidated Gold Mines (*bb*)	12.17	.....	(10)	150	Apr. 1936
Ymir Yankee Girl Gold Mines (*u*)	7.54	5.18	(3)	150	July 1934
Base Metals Mining Corp. (*e, ..*)	.....	.....	.....	300	Nov. 1937
Britannia Min. & Smelt. Co. (*a, p*)	.....	.....	.....	4,000	1903
Columbia Tungstens	.....	.....	.....	50	1939
Cons. Min. & Smelt. Co. of Canada (Kimberley (*p*)	.....	.....	.....	6,600	1906
(Tadanac (*a, y*)	.....	.....	.....	2,400	1906
Granby Cons. Min. & Smelt (Copper Mt. (*a, oo*)	.....	.....	.....	5,000	June 1937
Mining Corp. of Canada (Monarch (*p*)	.....	.....	.....	280	Jan. 1940
Pinchi Lake Mercury Mines (*r, ee*)	.....	.....	.....	800	1940
Western Exploration Co. (*p*)	.....	.....	.....	200	1942
Zincton Mines	.....	.....	.....	.....	1942

(1) Shut down Oct. (2) Shut down Sept. (3) hut down April. (4) Shut down May. (5) Shut down Aug. (6) Shut down July. (7) Shut down Dec. (8) Shut down June. (9) Shut down Jan. (10) Shut down Nov.

(*a*) Copper-gold producer. (*b*) Former producer. (*c*) Costs include all charges. (*d*) Shipping copper and sulphur concentrates. (*e*) Controlled by Mining Corp. of Canada. (*f*) Average ore grade 1939: 5.23% Cu; 0.71% Zn; 0.323 oz. Ag; 0.0321 oz. Au. (*g*) To shut down for Dec. through March 1943. (*h*) Controlled by Noranda Mines. (*i*) Controlled by Premier Gold Mining Co., one of the 10 principal foreign development companies of American Smelting & Refining Co. (*j*) Controlled by Ventures, Ltd.; 45% in Beattie Gold. (*l*) Before taxes, depreciation, and depletion. (*m*) Controlling mines in Portland Canal area, including the Premier, Canada's largest silver producer. (*n*) Shipping flux-gold ore to Noranda smelter. (*o*) Approx. monthly output 1939: 3 grams radium, 80,000 oz. silver; mine shut down 1940 and reopened Oct. 1942. (*p*) Lead-zinc-silver producer. (*q*) Also treating ore from Bradian mine. (*r*) Controlled by Cons. Mining & Smelting Co. of Canada. (*s*) Formerly largest B. C. gold producer. (*t*) Silver producer. (*u*) Lead-zinc-gold-silver producer. (*v*) Operating in bankruptcy under custodian. (*w*) Controlled by Howe Sound Co. (*y*) At Trail are located custom concentrator, zinc production plant and refinery, copper smelter and refinery, fertilizer plant, etc. (*z*) Controlled by Hollinger Cons. Gold Mines. (*aa*) Tungsten-Copper-gold produced in 6 months ended Dec. 31, 1941. (*bb*) Copper-gold-silver produced in 6 months ended Dec, 31, 1941. (*cc*) Controlled by Siscoe Gold Mines. (*dd*) Ore grade 1939: 2.01% Cu; 4.14% Zn; 0.106 oz. Au; 1.59 oz. Ag; smelter byproducts were cadmium, selenium, tellurium. (*ee*) No report since 1941. (*ii*) Controlled by Newmont Mining Co. (*jj*) Production in 1941 valued at $1,571,265; average ore grade 1939: 2.57% Cu; 8.307% Zn; 0.03 oz. Au; 2.946 oz. Ag; copper concentrates treated at Noranda. (*oo*) Production in 1941 valued at $4,876,275; 33,500,000 lb. Cu. (*pp*) Production in 1941 valued at $169,722,916; operating profit $78,472,839; copper-nickel ore contains important amounts of platinum, gold, selenium, and tellurium. (*qq*) Average ore grade 1939: 1.97% Cu; 0.011 oz. Au; 0.43 oz. Ag; 50% sulphur concentrates; 1941 production, $2,051,246. (*vv*) Copper-zinc-gold producer. (*ww*) Production in 1939: 83,257,148 lb. Cu; 266,532 oz. Au; 595,102 oz. Ag; in Montreal a subsidiary refines blister copper from the Noranda and Flin Flon smelters. (*xx*) Operating the Thompson Cadillac mill. (*zz*) Production in 1941 valued at $7,267,822; net profit, $993,986.

converting all productive facilities to war purposes, as the last reserves of material, labor, and machinery became depleted. An Order-in-Council at Ottawa had the effect of freezing gold mining along with all civilian industry, as that part of the national economy not contributing directly to the war effort. In an effort to simplify and standardize, all activity is being concentrated on the defense program and the manufacture of armaments.

Labor shortages in all mining camps was the primary problem with which the Canadian mineral industries had to contend. In the first three months of 1942, according to the Dominion Bureau of Statistics, about 27,000 men were employed in gold mines, "but this gradually sloped off and in October was about 20,000." Although coal and base-metal mines suffered a direct loss of manpower, which was aggravated by a high percentage of absenteeism, gold mining was hampered to a much greater extent.

Going back to October, 1941, as a basis of comparison, an index prepared by the Canadian Bank of Commerce shows that mining payrolls in that month reached the high point of 133 (1937=100), against a total of 189 for all Canadian industry. A year later, in October, 1942, payrolls for all industry had advanced steeply to 222, and mining payrolls were down to 111. Although the value of mineral production increased about 25 percent from 1937 to the end of 1942, mine payrolls were only 18 percent higher at the end of the period that marked an appreciation of more than $100,000,000 in the value of annual mine output. The accompanying summary of mine payrolls since 1937 gives emphasis to the erratic trend in 1942 between January and October:

Mine Payrolls Since 1936

		1942	
1937	100		
1938	99	Jan. 122	Aug. 109
1939	109	Feb. 116	Sept. 107
1940	113	June 105	Oct. 111
1941	118	July 112	

In addition to the standard cost-of-living bonus that applies to all Canadian workers, mine wages have been gradually advancing to a more competitive level. The acute shortage in Western collieries and base-metal mines has been relieved by the release on furlough of several hundred men from the armed services. Employment of what is still gingerly referred to by the newspapers as "female labor" is becoming general. Unskilled workers (Indians, French-Canadian colonists, and other settlers) have been recruited, particularly by the struggling gold mines, where a labor reserve is available for base-metal operators in the same area. This general set-up applies particularly to the mining camps of Quebec and Ontario, but it is believed to apply elsewhere in the Dominion, also.

Gold mines that continue to keep their mills running with a severely restricted tonnage have been obliged to eliminate all but essential development work, to use hay wire rather than order new repair parts, and to hire women, boys, and old men—almost anyone who is able to walk without crutches. As examples of the effect of war conditions on gold production, only a dozen gold mines were reported still in operation in British Columbia at the end of the year, after more than that number had shut down; a dozen closed in Ontario in 1942 and four in Quebec, and the Metals Controller issued permits under special conditions, early in the year, for one new gold mine in each of the two last-named provinces to start production (Yama and West Malartic). Several mines continued to function at around half of their rated mill capacity, and Hollinger, Canada's largest gold producer, has dropped from 5,200 tons a day to about 3,500.

It should be pointed out that figures compiled in Table II under the heading "Daily Mill Tonnage, 1942," do not, as formerly, represent the average as published in the last annual report or in officially announced production for the first three quarters, but rather indicate the minimum daily tonnage milled for the month of September or October. In this way, the accompanying tabulated data offer an index of the extent of curtailment imposed by present conditions, and without government regimentation, on the gold mining industry. This same Table II indicates the mines that were shut down during 1942, but does not list a number of others that closed late in 1941 and which were shown as operating in the similar tabulation that was published with this annual review of Canadian mining a year ago (see *E.&M.J.*, Feb. 1942).

In connection with the labor problem, it is relevant to mention that the Porcupine camp, including the city of Timmins, grew from less than 4,000 in 1921 to about 47,000, according to the census of 1941. It has been estimated that upwards of 10,000 people have recently moved away, either to get into uniform or to work in the congested industrial centers to the south. Kirkland Lake has had its former population of about 23,000 reduced by more than 7,000. On the other hand, the major expansion of the essential nickel industry at Sudbury has led to organized efforts to maintain the labor supply by bringing in workers from other mining camps. Noranda and other Quebec base-metal operators have likewise drawn labor replacements from nearby gold mines.

Though mineral output in Ontario declined 3.3 percent last year, Northwestern Quebec's mining camps were enabled to report an advance of 5.1 percent in the combined value of base metals and gold, a total of $104,749,101. Noranda, in addition to being one of the world's great copper mines, ranks second to Hollinger among Canadian gold producers, there is also an important gold content in the zinc-lead ore of the Golden Manitou and Tetreault mines and the copper ore of Mic-Mac Mines, all three of which went into production in the second half of 1942. New Calumet was expected to tune up its new 300-ton zinc-lead concentrator before the end of December. All Quebec operators have drawn heavily from the formerly untapped local sources of unskilled labor, so that 50 percent or more of the average crew is now French-speaking. The policy in recent years of carrying development well beyond current mill demands has made it possible for short-handed mines to supply mill feed at close to the rated tonnages.

Table III—Output of Canadian Mineral Industries *(a)*

Year	Metallics	Non-Metallics	Gas, Oil, Coal & Peat	Structural Materials & Clay Products	Total Value
1919	$73,262,793	——$76,002,087 (*b*)——		$27,421,510	176,686,390
1929	154,454,056	$21,073,959	$76,787,397	58,534,834	310,850,246
1939	343,506,123	25,061,849	70,671,328	35,362,759	474,602,059
1940	382,503,012	26,011,498	78,837,874	42,472,651	529,825,035
1941	395,346,581	34,379,440	85,141,997	45,373,272	560,241,209
1942	392,762,562	36,139,173	90,305,631	44,982,995	564,200,000

(*a*) Data issued by Mining, Metallurgical, and Chemical Branch, Dominion Bureau of Statistics (*b*) Combined value of non-metallics and fuels for 1919. (*c*) Official Ottawa estimate, Dec. 30, 1942.

Table IV—Index of Canadian Activity *(a)*

	Utilized Percent of Current Capacity			Percent of General 1937 Activity		
	1941	1942		1941	1942	
Group	Jan.	Jan.	Nov.	Jan.	Jan.	Nov.
Iron and steel trades	104	152	170	211	292	369
Heavy	108	157	192	305	393	514
Medium	98	147	156	130	225	252
Light	105	150	145	127	199	212
Non-ferrous metal products	110	144	154	136	181	205
Non-metallic mineral products	75	79	102	91	102	171
Chemicals	97	104	108	108	117	127

(*a*) Based on data compiled by the Canadian Bank of Commerce.

MEXICO

Metal purchases by United States Government and search for new deposits stimulate increased activity in mining. Skepticism as to post-war period acts as brake. Labor still proves difficult

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THE MOST IMPORTANT EVENT in Mexican mining during 1942 was the agreement between Metals Reserve Co. and Mexican government officials, referred to as the Bateman-Suarez-Tellez agreement. Alan M. Bateman, representing Metals Reserve Co., and three Cabinet members, namely Lic. Eduardo Suarez, Ignacio Garcia Tellez, and Francisco Javier Gaxiola, held discussions during February, in Mexico City. They reached agreements whereby Metals Reserve contracted to buy up to 75,000 tons of copper, 250,000 tons of lead at 5.40c. per pound, and 200,000 tons of zinc at 8.25c. per pound each year for the duration, and extendable by mutual agreement after the war. Mexico agreed to stabilize taxes on lead, zinc, and copper, to freeze freight rates, and to hold in abeyance certain clauses in the labor laws, particularly one which pertains to employee housing. Also, there was assurance by labor leaders of a cooperative and liberal attitude with an effort for increased efficiency to make up for increased labor costs.

Since then, Metals Reserve Co. has expanded the market for and stabilized prices of other metals and minerals, so that Mexico now has a market for all that can be produced.

Assurance that the things agreed upon would be done has been a factor favorable to increased mining activity, and the industry has shown a definite trend of expansion. No production statistics have been available since Mexico entered the war. These, however, would indicate only what is going on in the mines already in operation and would not show that prospectors and small miners are again active and that engineers of both American and Mexican companies are examining promising prospects. Several companies which have not had scouts in the field for years are re-establishing their exploration departments and actively searching for new properties. None of the larger operations has shut down; several have increased milling capacity, and a casual inspection along the railroads shows ores being loaded at many stations for the first time in years. Experienced men, such as engineers, shift bosses, and mechanics, are increasingly hard to find and, to keep them, increased wages are being offered.

Several factors, however, are retarding the expansion of mining. The principal brake is the skepticism of some mine operators as to whether the present favorable conditions will continue after the war. Many enterprises have been on a salvage basis for years, trying to save what they could of their original investments, and the operators are now entering upon new ventures with caution and limited commitments. Others, which have been active mainly in gold and silver mining, are turning to base-metal mines.

Other factors seriously retarding expansion are: 1, difficulty in obtaining and maintaining equipment; 2, hesitancy of American buyers to quote firm prices on certain ores, such as tungsten, vanadium, and strontium; 3, existence of a transportation bottleneck on the railroads.

The type of mining which has expanded most rapidly is that in which little capital expenditure and equipment are needed, such as the exploitation of outcrops of deposits of mercury, antimony, manganese, fluorite, mica, and graphite. Such mines are usually in isolated places and few workmen are employed, so there is relative freedom from labor trouble and little time lag between production and earnings. The next most active group are deposits in old districts in which lead-zinc sulphides are known to exist through earlier exploitation, principally of silver ores. The lead-zinc minerals were left originally as unprofitable but now can be worked with minimum exploration and often with existing milling equipment.

As this is written, the Miners' Syndicate is threatening a general strike, unless its demand for a general 25 percent increase in wages is granted. This action is being taken regardless of the fact that several of the larger companies have recently completed discussion of collective labor contracts with the Syndicate, in which the workmen obtained wage increases up to 10 percent. Still other collective contracts with major companies are under discussion. The government is studying ways of bringing the railroad and petroleum workers under greater discipline and efficiency. These pressing problems will be decided outside of the industry, and whether the present expansion will continue during 1943 depends largely on the decisions.

Manufacture in Mexico of materials formerly imported is growing rapidly. Tin ores smelted in the country provide for domestic needs; a small antimony smelter near Mexico City is operating; also new paint pigment and chemical plants. Several new factories have been built to make hand tools, such as picks and shovels and hacksaws, and apparently are having success. The Real del Monte company is completing a zinc-dust plant and is studying the feasibility of augmenting carbide production and manufacturing cyanide, soda ash, and other heavy chemicals.

Iron and steel producers have been working at capacity. La Consolidada, S.A., was acquired by Shields & Co. de Mexico, S. A., and plans are under way to increase capacity. Cia. Fundidora de Fierro y Acero de Monterrey, S. A., has installed a modern blast furnace; and Hornos Altos, a new company with Mexican and American capital, has started construction of modern blast furnaces at Monclova, Coahuila. Plans for expanding coke production are being carried out, and the Mexican government is said to have contracted for the sale of coke and coal to other Latin American countries. The Cerro del Mercado, in Durango, is chief source of iron ore.

For several months Mexico had what looked like a "free silver" market, and the price rose rapidly from 34c. to over 60c. per ounce. Buyers were offering long-term contracts at this price when the Mexican and American governments stepped in and fixed the price at 44¾c. per ounce. With this increase, the Mexican government revoked the production tax and put on a new export and emergency tax of 10.92 pesos per kilo, 65 percent of the price increase.

Announcement has been made of a Reciprocal Trade Pact between Mexico and the United States. Among other items, the duty on machinery imported into Mexico will be reduced 50 percent; likewise the duty on lead ores imported into the United States will have a 50 percent reduction, and that on metallic zinc 40 percent.

SOUTH AMERICA

Conditions in general are unfavorable to the initiation of new mining enterprises. Properties already established increase their output. Operating costs tend to rise. Much exploration is under way. Gold output falls

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SOUTH AMERICAN MINING faced difficulties during 1942, arising from decreasing machinery, materials and fuel supply, and scarcity of competent technical personnel—factors affecting in particular small and medium-size mining enterprises active or under development. As a consequence, there were few if any new developments of magnitude. The important and well-established mining properties, especially the large copper mines in Chile and Peru, were subjected to stimulative measures, and the output increased. Diversion of shipping and shortage of bottoms after the entrance of the United States into the war was especially felt in connection with the exportation of low-valued material and inferior-grade products. Difficulty in obtaining adequate fuel for railroads and power plants in several countries has had serious effects on the internal transportation and power-generating systems, and government control over imports, exports, and exchange has increased, as have living costs, wages, and taxes. Dwindling gold-mining operations have to some extent reduced the amount of foreign exchange available for imports, which, together with other adverse outgrowths of the war, has not exactly stabilized the internal economies of several of the nations.

Immediately after Pearl Harbor the Metal Reserve Co. and the Bureau of Economic Warfare instituted measures to improve conditions in the mining industry. Favorable priorities were granted wherever possible, transportation facilities both on land and sea were investigated with a view of improving them in the shortest time possible, and competent technical advisers and personnel were sent to advise on exploration, development, management, and metallurgical matters.

ARGENTINA — Though mining is playing a somewhat subordinate part in the economy of Argentina, there has been a steady increase in production of metals and minerals from year to year. The tempo has been accelerated since the outbreak of the present war. In 1940, the total mine production, petroleum, natural gas, and cement excluded, amounted to $15,278,000, a substantial increase over the 1939 figure of $14,061,000, and production for 1941 and 1942 unquestionably will still be higher. Another factor that is encouraging search for and development of new sources of supply is the growing demand for metals on the part of expanding domestic industries. Interest in lead, zinc, tungsten, manganese, beryl, mica, and others of the strategic class continues. The lead-zinc mines in the provinces of Jujuy, led by the Aguilar of St. Joseph Lead Co., operated at capacity, and exploratory work is in progress at a lead deposit in the territory of Chubut. Concentrates are smelted at the Puerto Vilelas reduction plant of National Lead Co. The Pirquitas placer and lode holdings in Jujuy continue to furnish the bulk of tin production. Tungsten output (wolframite and scheelite) is had from many small-scale operations.

Manganese ore for domestic consumption is mined from deposits in northern Cordoba and southern Santiago del Estero. High maritime freight rates and lack of shipping space make shipment to the United States difficult. Copper is mined in relatively small quantities in Capillitas, San Juan, Salta, and Neuquen, and a small tonnage of vanadium is produced from deposits in the provinces of Mendoza and Cordoba. Production of beryl from the superficial pegmatite deposits in the San Luis and Cordoba hills has remained small, as has the output of antimony, bismuth, chromite, and mica. Gold is obtained from numerous placers.

BRAZIL—Expansion of mining operations continued during 1942. Minerals currently under exploitation and of primary importance to the United States include iron, manganese, rock crystal, mica, diamond, bauxite, and zirconium. Gold and coal are of interest to Brazil only. So far no large deposits of lead, zinc, and copper have been found, and the relatively small tonnage of lead produced in the State of São Paulo is absorbed in the domestic market. A 35-ton lead smelter is operated at Palmital. The enormous iron deposits in the central part of Minas Geraes are Brazil's largest and richest mineral reserve. Mines active include the Casa de Pedra, Pires, Tres Irmaos Ficho Funil, and Jangada. There are 14 iron-smelting plants in operation. A new iron and steel mill, the largest in South America, is now under construction at Volta Redonda, between Rio de Janeiro and São Paulo. Mining of manganese in Minas Geraes expanded steadily. The bulk of production was obtained from the famous Morro da Mina mine, near Lafayette, owned by the Companhia Meridional de Mineração and exploited by open-pit methods, followed by a group of mines controlled by A. Thun & Cia., including the São Goncalo, Paiva, Jurema, Cocoruto, Pequiry, and Bom Jardin.

Developments of ore that have been made at the Morro Velho mine of St. John del Rey company are encouraging, and troubles due to high temperatures encountered in the lower sections of the mine have been minimized by the installation of an extensive cooling and ventilation plant. Work also continued at the Passagem mine, near Ouro Preto, Juca Vieira at Caete, and São Bento, at Santa Barbara, all in Minas Geraes. Pyrite for use in sulphuric acid plants is mined by three companies near Ouro Preto. Operations at the bauxite deposits at Pocos de Caldas, Minas Geraes, are being expanded, and high-grade material is being exported to Argentina and the United States. Considerable attention is being given to the nickel deposits in Goyaz, Minas Geraes. Production of mica, rock crystal, diamonds, and zirconium continued at a steady rate.

BOLIVIA—Higher prices paid for tin and tungsten were a powerful stimulant to increased production. With practically the entire economy of Bolivia resting on its mining industry, increased exports mean improved times. Capacity output is maintained at the properties of the three principal tin producers—namely, Patiño, Hochschild, and Aramayo. Tin exports in 1941 reached 42,877 tons, and it is predicted that this figure will be exceeded in 1942. Patiño plans to install a sink-and-float unit at its Llallagua property, and exploration work is in progress at the Colavi holdings purchased recently by the company. Hochschild's mines, the Colquiri, Unificada, and others, are operating at capacity, and experimental work to improve tin recovery is in

progress. A sink-and-float plant and a pilot plant for the treatment of sulphide, complex, and low-grade ores by the Tainton process are to be installed at Unificada. The holdings of the Aramayo group in the Chocaya district have been increased by the purchase of the San Juan mine, and improvements made recently at the different units point to increased production in 1942 and 1943. Of the smaller properties active, the Racachas and Urania are receiving considerable attention. The Huanuni dredge continued operations, and interest is shown in some of the tin placers now idle. Tungsten production which is obtained from numerous small and medium-size operations is increasing. The Aramayo group continues to furnish the bulk of the output. Apart from the Tasna and Pacuni mines of Aramayo, there are active the Urania, Bolsa Negra Perfeccionada, and others. Private capital is somewhat hesitant in making large investments in tungsten mining because of uncertainty regarding the post-war market for tungsten. Antimony is mined by small groups of miners, and production in most cases is sold to the Banco Minero. Cia. Huanchaca, controlled by Hochschild, produces complex ores of lead, zinc, and silver, with Metal Reserve taking the bulk of the concentrates produced. Copper and bismuth production have not increased, and sulphur, cobalt, selenium, and mercury are mined on a small scale.

CHILE—Chile's great copper mines at Chuquicamata, Potrerillos, and Sewell maintained a high level of activity throughout 1942. No large additions were made to the existing treatment plants during the year. At Chuquicamata work on a large drainage tunnel to pass under the sulphide orebody has been started recently. Smaller copper producers in operation in Central Chile include Tocopilla, with mills at Tocopilla (300 tons) and Ovalle (700 tons), Ojancos, at Copiapo, and Farellon Sanchez, Mercedita, Volcan, and Carlota, in the Maipo valley near Santiago. The Chagres and Naltagua smelters operated at capacity, the former handling concentrates produced in the El Cobre and Caracoles mills, and the latter receiving the production of the 500-ton Disputada mill. They also treat copper and gold ores shipped from other properties in Central Chile. The Taltal, Copiapo, Andacollo gold-mining areas were more or less active. The Punitaqui mine, near Ovalle, where auriferous copper ore containing an appreciable amount of mercury is treated in a 400-ton selective flotation plant, worked steadily throughout the year 1942. Bethlehem Chile Iron Mines Co. has acquired the Romeral iron deposit between its Tofo iron property and La Serena, in the Coquimbo area, and at Tofo between 5,000 and 10,000 tons of ore and waste are mined per day by open-pit methods. Nitrate production has been nominal, with the Maria Elena and Pedro Valdivia treatment plants operating at more or less normal capacity. In the Province of Coquimbo are the manganese-mining districts of Corral Quemado, Arrayan, La Ligua, Las Canas and Marqueza.

PERU—Cerro de Pasco continues to be the largest producer of metals in Peru. In 1941 there were produced 35,378 tons of copper, 54,821 tons of lead, 24,358 tons of zinc, 1,816 tons of vanadium, 520 tons bismuth, 1,569 tons antimony, 245.5 tons molybdenite, 15,030,400 oz. silver, and 202.2 tons tungsten concentrates. The gold output amounted to 252,458 oz. Cerro de Pasco operations furnished the largest share of the copper, lead, zinc, bismuth, and silver output given. About 70 percent of the gold came from small and medium-size properties operated by Peruvian and American interests, employing a total of 9,000 men. Tungsten mining is increasing somewhat, and Cia. Minera Tauca, S. A., placed in operation a 25-ton concentrator in the later part of August. Panaminas, Inc., is completing a 20-ton treatment plant at its mercury holdings at Chonta, Department of Huanuco, and in the Huancavelica region, particularly in the Santa Barbara area, exploration work is in progress. Announcement by the Ministro de Fomento that negotiation have been entered into with the firm of H. A. Brassert & Co., of New York, consulting engineers, concerning establishment of iron and steel industries in Peru, has aroused considerable interest in the country and abroad. Under the plan, use is to be made of iron ore from the Marcona deposit, about 250 miles south of Lima, in the Department of Ica. The iron and steel plant will be at Chimbote.

ECUADOR—With the settlement of the Ecuador-Peru incident at Rio de Janeiro, more or less normal operating condition have been established again at the Portovelo mine of South American Development Co., the country's largest mining enterprise. The second largest mine is the Macuchi, operated by Cotopaxi Exploration Co. Both are gold producers. The Pilzhun lead-zinc-copper-gold-silver deposit in the Eastern Andes continues idle, and although discovery of stibnite, manganese, and copper occurrences have been reported, no actual development work has been started. Lack of capital, poor transportation facilities, and high interest rates on borrowed money have retarded development.

COLOMBIA—Gold mining is the second largest source of revenue in Colombia, and as a consequence plays an important rôle in the economy of the country. Production in 1941 amounted to 656,028 oz., of which about 48 percent was furnished by lode mines, and the remainder, or 52 percent, by placer mines. Some 80,000 men are actively engaged in mining and nearly 500,000 inhabitants derive a living from the industry. Platinum production obtained as a byproduct of placer gold mining amounts to about 1,500 kg. per year. Gold mining has dwindled somewhat in recent months but there is increased interest in the search for strategic minerals. There are known occurrences of lead, zinc, tin, bauxite, copper, chromite, mercury, and molybdenum, and exploration of some is in progress. Improved transportation facilities unquestionably will hasten development of non-ferrous minerals. The domestic iron and steel industry has been expanded by the erection of a steel mill at Medellin, containing two electric furnaces for melting scrap, two gas furnaces for heating ingots, and a 100-ton rolling mill, and starting up of an iron smelting furnace in the Pacho region of Cundinamarca.

VENEZUELA—Save for the erection of a treatment plant capable of handling 960 tons of material a day at the El Tigre asbestos mine, about 100 miles west of Caracas, owned and operated by Venezuelan interests, and preliminary development work at the Pao iron-ore deposit owned by a subsidiary of Bethlehem Steel Corp., no outstanding developments were reported during 1942. Gold constituted the bulk of the country's metal production, the 1941 output amounting to 4,056,314 grams. The mines of New Goldfields and the French Mocupia company, all situated in the Callao mining district, were the principal producers, furnishing 3,294,091 and 625,361 grams respectively. Another 136,862 grams were produced by small placer-mining operations active in the same area. Production of diamonds increased somewhat.

CENTRAL AMERICA

IN GENERAL the course of events in Central America in 1942 followed the usual rule that applies to most of the South American countries. Development continued to a certain extent, but it cannot be said to have been lively. In fact, during the later part of the year shortage of materials and supplies was reported from several Central American mining areas, which, if not remedied promptly, will

mean reduced operations and eventual shutdown of properties. This should be avoided at all costs, for in some republics the revenue derived from the mining industry governs both the economic and political ability of the country.

Mining in Central America has been exclusively devoted to the production of gold. Some deposits of strategic minerals are known to exist in the different republics, but no extensive explorations have been made until recently, and as a consequence only small tonnages are available for the present emergency.

No new developments have been reported from San Salvador, where small-scale gold mining operations are carried on in the Departments of San Miguel, La Union, and Morazan. The milling plants available vary in capacity from 40 to 65 tons.

The principal producers in Honduras are New York & Honduras Rosario Mining Co., at San Juancito, and Cia. Minera Agua Fria, S. A., near Delhi. They furnish the entire mineral production of the republic, which in 1941 amounted to 3,500,000 oz. silver and 23,000 oz. gold for New York Honduras and about 16,000 oz. silver and 12,000 oz. gold for Agua Fria.

In Costa Rica gold production comes from several districts, all on the western slope of the mountains facing the Gulf of Nicoya. Operations are conducted on a relatively small scale, and milling plants vary in capacity from 5 to 50 tons. The principal producers are the Abangarez holdings, operated on a leaser-contract system, with two mills capable of handling 50 tons; the Compania mine, with a 40-ton flotation plant; and the Juchem and Sanford operations near by, both in the Aguacate district, and the Bonanza mine, where the Rudin company has recently installed a small flotation mill. Total gold output in 1941 exceeded $550,000. The manganese deposits in Guanacaste Province remain idle.

Nicaragua is the largest gold-producing country in Central America. Yearly production is estimated at more than $7,000,000. Recent exploration work has failed to reveal commercial deposits of metals needed in the present war effort. Mining districts active during the year included Madriz, Leon, Chontales, and Matagalpa, and the principal mines in order of production (37,500 to 1,000 tons) are La Luz de Los Angeles, Neptune Gold Mining Co., Cia. Minera La India, Empresa Minera de Nicaragua, Cia, Minera del Javali, San Juan Mines, Inc., Cia. Minas Matagalpa, and Cia. Minera de San Gregorio. Most of the treatment plants employ the cyanide process.

AUSTRALIA

Government active with measures to stimulate the production of strategic minerals. Difficulties beset private mining. Manpower situation affects the output of base metals. Gold outlook discouraging

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Mining in Australia had to contend with major difficulties during 1942. In wartime, inconveniences and dislocations in the production of minerals and metals are to be expected and are unavoidable, but much of the trouble which has faced the industry during the year could have been modified, or even avoided, by foresight and intelligent consideration on the part of the government, aided by coordination among departments.

The need for increased output of minerals and metals became particularly necessary at the beginning of 1942. Individuals and companies were urged to secure greater production, and a special organization, known as the Minerals Production Committee, was formed by the federal government to expedite the mining and treatment of strategic minerals by finance, the provision of equipment or the supply of labor, and also to engage in mining on its own account.

At the same time, extended operations by private enterprise were flatly discouraged by taxation. The wasting nature of a mining asset was ignored and an exemption from tax of 8 percent on capital was allowed to mining companies. A proposal to reduce this exemption to 4 percent was strongly opposed and abandoned. Recently, the tax exemption has been raised to 20 percent, and the benefit has been passed on to shareholders, a provision which was at first refused. Further discouragement to production of base metals has been given by the curtailment to the extent of 66 percent of the exemption from tax of calls paid to mining companies by shareholders.

Base-metal production is seriously retarded by the inefficient control of manpower. This section of the industry is nominally protected, but the absence of coordination among government departments, and the lack of powers on the part of the department responsible for mineral production to secure and retain essential labor, have resulted in a decrease of manpower to an extent that some mines are unable to maintain a normal rate of development, and expansion is impossible. In calling up men for national service no consideration is given to the matter of individual efficiency; consequently the ill-effect of a diminished labor force is intensified by a reduced output per man. In fact, the objective of manpower control appears to be obtaining the greatest possible number of men, first for the military forces and second for the manufacture of munitions; the fundamental and vital task of insuring adequate raw materials seems to merit scant consideration.

Gold mining has faced similar difficulties. A year ago the government was emphatic that the industry must be maintained. This attitude was then completely reversed and gold mining was regarded as valueless to national normal or war economy. Government policy threatened the extinction of the industry, not only present but for posterity. Opposition, however, secured some belated recognition of the value of gold mines as a national asset, and this side of the industry has been allotted a maximum labor quota to keep the mines dewatered and to insure maintenance of the workings against the time of reopening. The costs of this work will be met by limited production, and where this is not possible, financial assistance is to be provided. Mines on which isolated townships entirely depend, will be allowed a quota practically sufficient for normal working. Against this, there is no provision for efficiency in the manpower allowed, nor is there any certainty that the quota provided for can be obtained or kept on the particular mines; and, further, it may still be diminished by calling up age groups. It is, therefore, impossible for companies to prepare, or follow, concrete plans for the immediate future, for a degree of uncertainty still exists which, through government indifference, has done great harm in recent months to a very important

industry. The government attitude may be exemplified by an utterance of one of its prominent members condemning the provision of reasonable and soundly based depreciation in the steel industry.

Activities in base-metal mining are directed to increasing the production of copper, tin, wolfram, and scheelite. There are no new discoveries to develop, and abandoned mines offering promise of supplies of metal are being prepared for renewed operation. The main increase in these four metals is looked for from Queensland, New South Wales, and Tasmania, with smaller quantities from Western Australia and the Northern Territory.

Production of non-metallic minerals is assuming increasing proportions, and in this field South Australia is prominent. Mica mining is expanding in the Northern Territory, and Western Australia is expected to contribute potash and an increasing supply of asbestos.

WESTERN AUSTRALIA—The gold yield of the State to Aug. 31, 1942, was 506,553 oz., which compares with 716,021 oz. for the corresponding period of 1941. As the effects of drastic labor curtailment would become most evident in the following months, a heavy decrease in gold production can be expected.

An outstanding development on the Kalgoorlie gold field was the opening up in the mine of Paringa Mining & Exploration Co., Ltd., of a rich ore-shoot reminiscent of the early days. An exploratory crosscut at the 520-ft. level intersected a lode 24 ft. wide which assayed 37 dwt. gold per ton over the full width. Subsequent driving disclosed an average grade of ore of 89 dwt. per ton over the width of the drive for a distance of 121 ft. Boreholes established high values beyond the sides of the drive, and stripping is in progress. The shoot was located at the 640-ft. level, but values were lower, driving having disclosed an average value of 12.84 dwt. per ton. This rich occurrence is on the contact of quartz-dolerite-greenstone and calc schist.

Considerable interest attaches to developments in the Sons of Gwalia mine, at Leonora, 150 miles north of Kalgoorlie. This is one of the deep mines of the State and has reached a depth of 5,000 ft. on the underlay, equivalent to 3,400 ft. vertical. As the pitch of the orebody is carrying it considerably south of the main shaft, a new internal shaft will serve the mine below No. 30 level. At No. 31 level, the orebody is in course of development; a section of low-grade ore was met, but recent work has shown important lengths of ore assaying from 4.9 to 9.4 dwt. per ton over a width of 96 in., which is that of the drive. Similar good results have been recorded at No. 29 level, the objective at the higher horizons being the South Gwalia orebodies. In the last financial year, 150,490 tons of ore was treated for a return of 42,520 oz. of gold, the average grade of ore won being 6.05 dwt. per ton. Despite the difficulties of the times, working costs, in British currency, were 22s. 9.4d., compared with 22s. 6.5d. in the previous year, exclusive of development. The company's usual output of 11,000 tons of ore per month has been reduced to approximately 8,000 tons through manpower difficulties.

Antimony production is a matter of importance. Hitherto, antimonial concentrate from Wiluna Gold Mines, Ltd., supplied a large part of the country's output of this metal. Owing to the approaching depletion of the antimonial orebody, the mine's production will soon cease. The Blue Spec mine and adjacent leases, near Nullagine, in the northwest of the State, are potentially important, and financial aid has been granted by the federal government to enable the operating company to carry out work essential for increased output of antimony concentrates. The ore occurrences are along a shear zone extending for 11 miles. In the Blue Spec lease, development has been carried out in ore for a length of 230 ft. and to a depth of 244 ft. which has proved ore reserves of 17,000 tons having an average content of 17 dwt. gold per ton and 3 percent antimony. There are substantial lateral extensions of lower-grade ore excluded from reserves, for the lateral limits of the lode are economic, which may become workable with increased output and lower operating costs. There is marked increase in the antimony content of the ore with depth on the main lease, and neighboring ore occurrences show values exceeding 3 percent at shallow depths. Concentration is effected by selective flotation, giving a clean antimony product assaying approximately 60 percent antimony and 5 oz. gold per ton, and a pyritic fraction assaying approximately 3 percent antimony and 4 oz. gold per ton. On the adjoining lease a body of antimonial sulphide ore, having an average width of 4 ft., has been opened up to a shallow depth for a length of 300 ft. The field is regarded as a likely successor to Wiluna as an important source of antimony.

Important progress has been made toward the production of potash. Boring at Lake Campion to the northeast of Perth, has proved this lake deposit to contain 16,000,000 tons of high-grade alunite clay with a content of 1,750,000 tons of potash, 3,250,000 tons of alumina, and 750,000 tons of sulphur. The surrounding country carries ample timber suitable for fuel, and ample water is available. Plant construction is well advanced, and it is anticipated that potash will be produced at less than the pre-war landed cost of imported potash. Research into the recovery of byproducts is giving encouraging results.

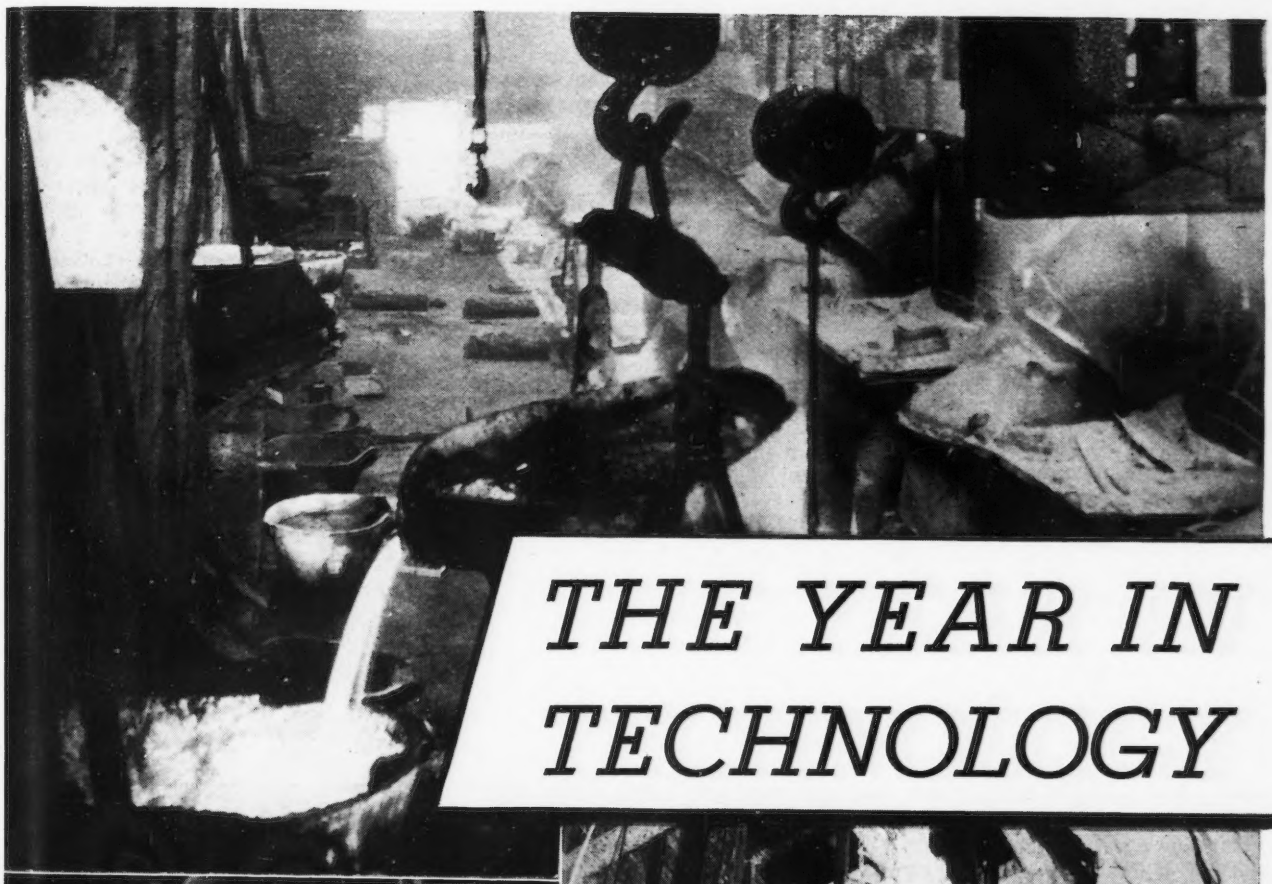
NEW SOUTH WALES—Broken Hill Proprietary Co., Ltd., the main activities of which are centered in the steel works and subsidiary enterprises at Newcastle, and the operations of Australian Iron & Steel, Ltd., at Port Kembla, has concluded another year's work of the greatest national importance. Despite the difficulties caused by three years of war, the price of steel was not increased until recently. In the last financial year a net profit of £A687,711 was earned, after providing £A1,025,013 for depreciation, £A750,000 for income tax, and £A550,348 for special depreciation on plant and machinery connected with wartime activities. A most important adjunct to the enterprise is the ferro-alloys plant, which is producing full requirements of ferromanganese, ferrosilicon, ferrochrome, ferrotitanium, ferrozirconium, and ferromolybdenum, as well as calcium carbide for the manufacture of magnesium. The magnesium plant is working to full capacity and several alloys of the metal are being produced. An outstanding achievement for the year is the production of tungsten carbide, the technique for which was developed by the company's staff in the absence of data on overseas methods. At present B.H.P. tungsten carbide tips are being largely used in the Commonwealth.

The company's subsidiaries are engaged in the production of special quality steels, steel and alloy castings, wire ropes, and a wide variety of munitions. To supplement supplies of iron ore, from the deposits in South Australia, several occurrences in New South Wales, small by comparison, and of varying grade and composition, are being mined. The new steel center at Whyalla, South Australia, is growing in importance. To supply limestone flux for the iron furnaces, a large quarry at Rapid Bay has recently been equipped.

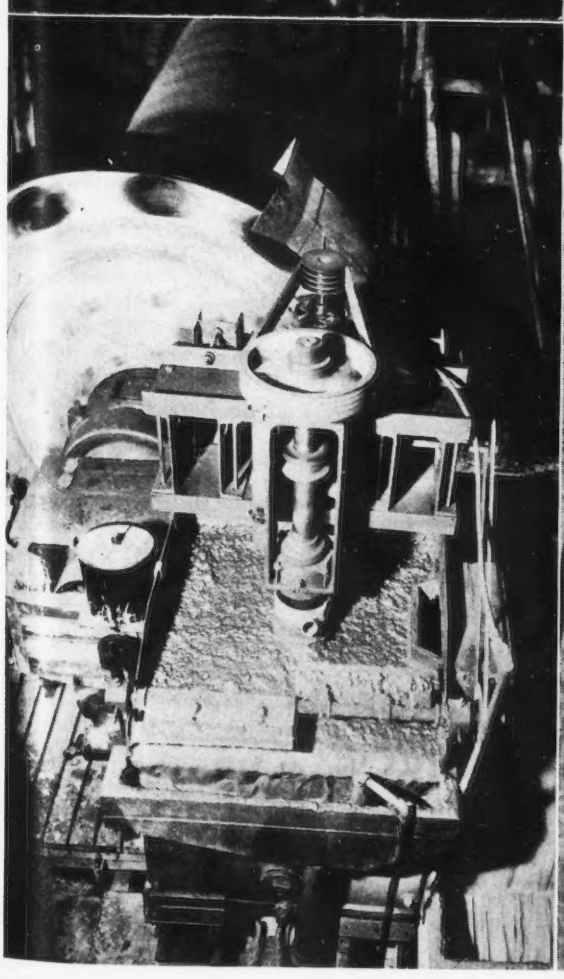
Increased copper production is to be obtained from the Cobar district. New Occidental Gold Mines, N.L., which also operates the adjoining New Cobar mine, containing copper-gold ore, has recently made provision for increasing output. The neighboring Chesney mine, which has important reserves of copper ore, has been unwatered and will be brought into production. Ore from both mines will be concentrated at the plant of New Occidental.

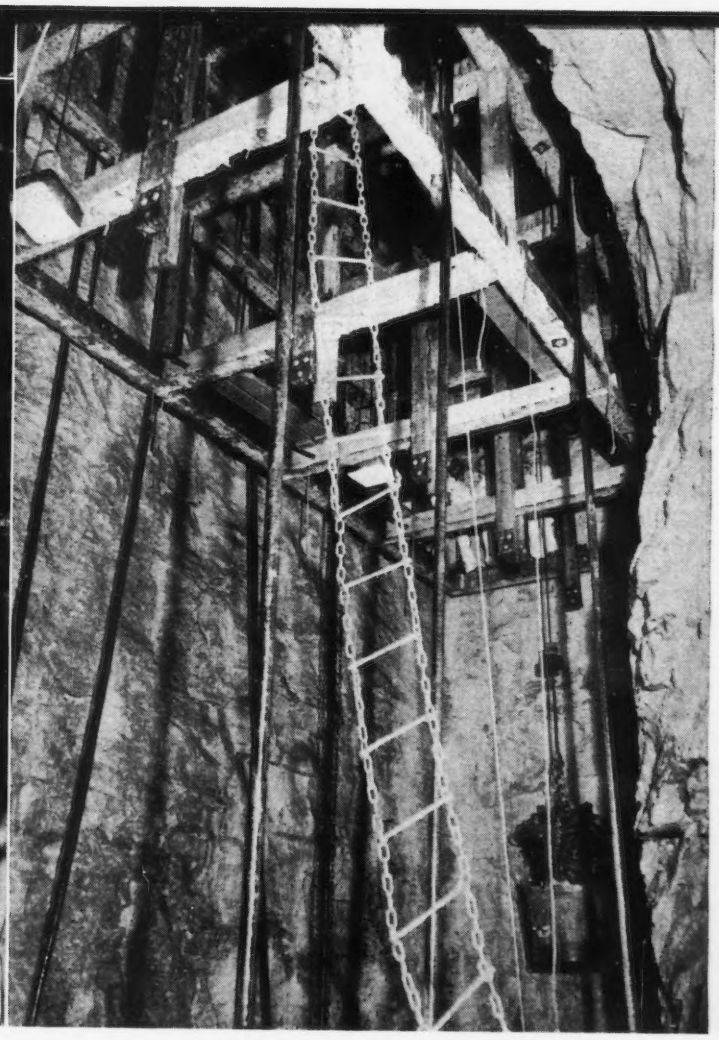
Production of gold in New South

(*Continued on page* 152)



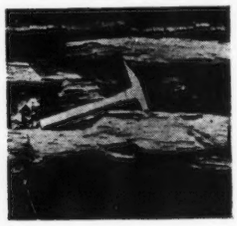
THE YEAR IN TECHNOLOGY





MINING GEOLOGY

Search for supplies of necessary minerals keeps profession busy. Opportunities for testing theories of mineral distribution



Charles H. Behre, Jr. *Professor of Geology, Columbia University, New York*

THE KEY to the unique developments in mining geology in the past year has been the war. Any account is best pictured by describing how the profession has been occupied since the opening gun was fired at Pearl Harbor. Unlike preceding years, the story can best be compressed into two words, prospecting and production.

By 1940 American mineral exploration had already been greatly stimulated in an attempt to serve the ever-increasing demands of a Europe at war. But war psychology had not yet come to dominate the thinking of mining men.

Pearl Harbor changed all that, but not at once. For it took some time for isolationism to be wholly abandoned, especially in the interior of the continent. Moreover, the limitation placed upon raw-material consumption was not strongly felt until the full effect of Philippine and East Indian invasions by Japan had begun to weigh upon us. Then, slowly, in the early months of 1942, Americans began to realize that Asia as a source of raw mineral materials bulks far larger than Europe for us in the Western Hemisphere.

For the professional mining geologist the increase in pressure was at first too gradual to be recognized. Today, however, it is felt in many ways. For one thing, the profession is almost rushed off its feet with demands. As a consequence of the first World War, a careful groundwork had been laid by the Government bureaus for supplying data on mineral reserves. It had been recognized that some materials were "critical"—that is, that the national supply of these goods would be scarcely adequate if war came. Others were classed as "strategic," implying that world strategy would require our making these available by stockpiling or by conquest if the war was to be fought on a footing at all equal to that of a first-class adversary. Efforts had indeed been made, rather inadequately as it afterwards developed, to stockpile the strategic minerals. But there were miscalculations both ways: materials believed to be available in adequate quantity ran low as shipping became difficult or new countries were overrun; conversely, reserves regarded as negligible proved more valuable than had been anticipated.

To supply the shortages mining geologists were called upon in 1942 for energetic search within the United States. Possible tin sources were re-examined. Manganese and chromium ore were sought with better success, and two large deposits were opened by private companies as operators under government auspices. New necessary reserves were found. A large tungsten deposit was discovered. The non-ferrous base metals were studied, not only to develop ores of grades especially desirable for military use but also to make such ores available in regions favorably situated to fabricating and consuming centers. Much the same applied to iron and bauxite exploration. The Bureau of Mines and the Geological Survey began an active campaign of exploration, examining deposits first geologically, then by supplementary drilling, and finally, in some of the more striking cases, working with other government agencies, to encourage private mining by competent operators.

Simultaneously mining geology came in demand in another way. The newly created government branches dealing with raw materials were heavily recruited from the ranks of mining engineers and mining geologists acquainted not only with the character of a given ore deposit but also with the extraction of the metal or non-metal, its utilization, and the geographic factors of supply, transportation, and consumption.

Moreover, with increasing efforts to establish close international relations with our sister republics in Latin America, largely through the staff of the Coordinator of Inter-American Affairs, engineers and geologists from the United States began to be called for by the State Department, the Board of Economic Warfare, and other agencies engaged in promoting such good will. This work, too, has led to to a reappraisal of resources not hitherto well known.

Much of the work being done by mining geologists is not subject to public review at this time, for strategic reasons. Some finds have been a mere matter of chance. Others have been the result of careful reasoning and detailed observation by the staffs of private interest or government agency. Some have resulted from the work of both groups in close co-operation.

Regrettably, the increasing need for mineral resources has not brought in its train any fundamentally new geologic methods for searching for minerals. Probably the very pressure of urgent need has discouraged the speculative thinking that is so often the source of a new method. Petroleum development, suffering from the competition of other mineral production in fields where the reserves are more obviously threatened with shortage, has taken a back seat; the energy and inventive genius of this branch of the profession has been diverted largely into strictly military objectives. This diversion may prove later to have been a serious mistake. American ground-water specialists and engineering geologists from Hawaii to Africa have been very busy with exploring foundations for depots and barracks, and with providing adequate water supply for cantonments and plants.

For a while the universities, colleges, and technical schools were able to carry on limited research programs, but by September, 1942, it became apparent that the non-military student, other than the rare "geologette," would be drawn into military service. Faculties, recognizing the shift in emphasis, made progressively greater efforts to take part in the various army or navy training programs or sought to integrate their own efforts with those of private capital or state or federal governmental units engaged in prospecting or in a study of the economic picture for use by the government. Still others entered various "intelligence" units of the armed forces. Little by little such men were withdrawn from basic research as applied to mining geology, until by now relatively few are left to press for an understanding of mineral deposition, petroleum accumulation, or water migration or to develop new methods for the search for mineral reserves.

Though interest has thus been drained from theoretical and fundamental exploratory work, the war has in one way furnished unusual opportunities for testing theories of mineral distribution. Previously, presumptive occurrences frequently could not be drilled or drifted for, because

the economic risk was too great. Now government expenditures on exploration have been justifiably large on the theory that a raw material exceeded in value any theoretical costs not measured as prohibitively high in terms of the two prime national resources, man-hours and available machinery. Moreover, government subsidies have become increasingly available. Such investigations have netted data on the workability of low-grade manganese ores in South Dakota, of low-grade tin ores in Bolivia, and of iron ores the geographic position of which was their unique asset. There can be little doubt that the end of the war will find the nation supplied with far more detailed and newer appraisals of its mineral resources.

Meantime, actual descriptions, in part factual, in part interpretative and theoretical, are not lacking in recent technical journals, though a decline in the quantity of such publications seems to be setting in. Interesting recent accounts of American mineral deposits, together with some theoretical deductions, in addition to the recently instituted strategic minerals publications of the U. S. Geological Survey; include: the native copper near Jefferson City, Mont.(*Econ. Geol.,* 17, pp. 126-135); the Ororo tin district, Bolivia (*ibidem,* pp. 87-115); the great copper deposits at Ajo, Ariz. (*ibidem,* pp. 247-309); . . . the silver ores of Ashbrook, Utah (*ibidem,* pp. 466-502); the manganese deposits of the Olympic Peninsula (*E. & M. J.,* 143, No. 9, pp. 52-54); the El Callao gold district, Venezuela (*ibidem,* No. 3, pp. 52-55); the gold deposits of Antioquia, Colombia (*ibidem,* No. 4, pp. 64-82); the asbestos districts of South Africa (*ibidem,* No. 7, pp. 62-64); the famous nitrates of Tarapaca and their origin (*Econ. Geol.,* 17, pp. 188-214); and two different groups of manganese deposits in the southeastern states (*ibidem,* pp. 163-172, pp. 408-423). G. M. Schwartz has returned to the subject of exsolution so fruitfully studied before and suggests a refinement of criteria (*Econ. Geol.,* 17, pp. 345-364). Bandy offered a stimulating criticism of Newhouse's interpretation as to the direction of flow of mineralizing solutions as determined by crystal form (*Econ. Geol.,* 17, pp. 330-333).

Papers of still broader implications in their bearing upon ore deposition include A. M. Bateman's discussion of the types of magmatic segregates, some of which are strongly suggestive of hydrothermal veins in form and age and which Bateman attributes to volatile-rich melts (*Econ. Geol.,* 17, pp. 1-15). J. S. Brown infers from theoretical considerations that groundwater movements, especially as related to oxidation and to primary mineralization, may be due in part to variations in density, rather than to mere artesian head (*ibidem,* 17, pp. 310-317).

Special attention continues to be devoted to structural control of mineral deposition—the outstanding emphasis of the last decade of mining geology. Fowler contributed a brief summary (*E. & M. J.,* Vol. 143, No. 11, pp. 50-52), showing where, with structure and stratigraphy in mind, new orebodies might most hopefully be sought. Interest initiated by the Committee on Processes of Ore Deposition of the National Research Council led to the publication in 1942 of a book that has been in careful preparation for several years. "Ore deposits as related to structural features" (Princeton Press, 1942), edited by W. H. Newhouse. This volume contains condensed descriptions of about 75 districts. Originally intended as a statistical approach to the question of the causes for ore localization, it has perhaps not quite come up to that hope; this is through no fault of the plan nor of the collaborators but because each district possesses factors that differentiate it at least in some measure from other districts with which it might otherwise appear comparable. Thus the Aspen, Colo., deposits, related to intrusions that are petrographically identical with and occurring in sediments that are stratigraphically and lithologically closely similar to those at Leadville, yet differ from the ore deposits of the latter, just as these in turn are somewhat different from those at Alma, only a few miles distant. Despite this difficulty, the book will long serve as an excellent summary for many districts, some of which, such as those described from Australia, Japan, and Latin America, are far from well known to North Americans. The two introductory chapters by B. S. Butler and T. S. Lovering and the carefully prepared summary by Newhouse are invaluable.

A New Text

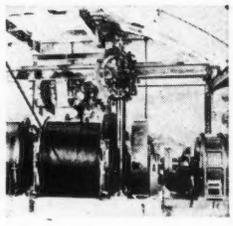
Of much the same order of interest is the new text "Economic Mineral Deposits" by A. M. Bateman (John Wiley & Sons). The value of a given textbook can always be debated by an opponent, since any estimate is affected largely by the objective which the critic has in mind. The range of texts in this subject is aptly represented by three well-known and useful books of older standing, those written by Prof. H. Ries, by the deceased Prof. Waldemar Lindgren, and by Prof. E. R. Lilley. Brief characterizations are always inaccurate, but the present writer (who has used all three texts for various types of students) is tempted to describe each with a single adjective—to wit, respectively, "encyclopedic," "theoretical," and "economic." Each of the three lacks some desideratum which the wise instructor will seek to supply. Professor Bateman's book, like the others pointed but thorough, has as its unique quality its emphasis upon application and practical methods. Perhaps even in it there is some room for a little more of the same. In any case, it appears to have been written less for the student of the theory of mineral deposition, less also for the geologist turned world economist; it is primarily designed for the practising mining geologist.

Another volume of much interest in that it contains several excellent papers on the geology of industrial minerals (non-metallics) is the recently issued Volume 148 of the A.I.M.E. *Transactions.* This contains about 35 papers written chiefly, but by no means wholly, from the practical viewpoint, and dealing with aggregate materials, barite, clays, diatomite, magnesium sources, mica, ocher, phosphate rock, potassium sources, pyrophyllite, salines of various kinds, spodumene, and several phases of cement making. Yet other volumes that appeared in 1942 and may be conspicuously useful to the mining geologist are the new edition of Nevin's "Principles of structural geology" (John Wiley & Sons) and the volume by A. J. Eardley, "Aerial Photographs, Their Use and Interpretation" (Harper & Brothers).

Many articles which deal with mineral economics or more strictly geographic and industrial aspects of mineral deposits have recently been published, as though prompted by our newly acquired global outlook. Among these should be mentioned: a good description of Spain's mineral industry (*E.&M.J.,* 143, No. 5, pp. 55-57); tungsten production in Canada (*ibidem,* 143, No. 10, pp. 55-59); a summary of the present world situation of antimony (*ibidem,* 143, No. 9, pp. 62-63) and of tin (*Min. and Metall.,* 23, pp. 501-505); high-silica bauxite and clay sources as ores of aluminum (*ibidem,* 23, pp. 507-508); iron ores and other raw materials of possible use in an east Texas iron smelting industry (*ibidem,* 23, pp. 417-419); and North Carolina olivine as a potential source for magnesia (*ibidem,* 23, pp. 331-333). For those interested in South American mineral deposits the excellent description of several districts and operations in Brazil, Chile, Peru, Bolivia, Ecuador, and Colombia (*E.&M.J.,* 143, Nos. 3-6) is most valuable; so also is the separate issue of *Engineering and Mining Journal* (Vol. 143, No. 8) devoted to Latin American mining.

MINING PRACTICES

Maintenance and salvage win new importance. Improvement in haulage and transport units gives greater efficiency



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OVER-ALL EFFICIENCY of mining operations continues to improve through constant study of haulage cycles and development of new haulage equipment. The well-established circle-spot and dual-spot cycles for truck loading find counterparts in figure-eight loading for wheeled scrapers, slot and dual 'dozing for tractor 'dozers. Trucks of many new designs offer fresh competition to older proved models, with freedom from breakdowns. One new truck-trailer design employs coiled instead of semi-elliptical springs to prevent side-sway and spillage and to reduce repair time. Spring replacements are fewer and cheaper. The unit can operate with a broken coil if necessary. Big loads can be hauled to small hoppers by using double-bodied trailers so that each half can be dumped separately. Truck haulage is playing an important part in moving old mine and tailing dumps in the lead and zinc districts. As many open-cut mines grow deeper, truck-to-conveyor-belt haulage increases in favor over rail haulage.

A heavy-duty conveyor belt of radically new design over 1,000 ft. long now elevates iron ore 250 ft. in a single lift. The belt structure consists of a single layer of steel cables located in the neutral axis with sufficient plies of woven fabric to provide lateral strength and stability. Total belt tension is 700 lb. per inch of belt width. The installation eliminates the intermediate transfer drive station with the chute, accessories, and maintenance which would be needed with shorter belts.

Rubber-tread impact troughing idlers solve the problem of belt bruising and cutting at loading points and can now prolong conveyor-belt life in many installations. One underground coal-mine conveyor employs an automatic car spotter at the discharge end. Discharge is at the rate of 6 tons per minute. A barney pulls the entire trip forward exactly one car length. It then stops and returns one car length to engage lugs on the next car.

Winter haulage problems are currently of unusual importance. For cleaning sticky or partly frozen material from truck boxes, the dipper of a front-end tractor shovel is replaced with a wide boom. On its outer end a blade just wide enough for the truck box makes thorough box cleaning possible. Such a device has been suggested for cleaning frozen dirt from stripping cars in winter. One operator now uses an oil burner to keep salt tanks hot and makes the winter car cleaning item less expensive than using live steam.

Loading problems have become acute as labor shortage increases. Two men with an underground power shovel now do the work of five hand loaders in certain mines which were formerly hand-loading camps. Such loaders are increasing in popularity and certainly assist in lessening the stress of man shortage. Various ingenious loading track layouts are being used to reduce the delay between car spottings. Such arrangements often include prefabricated portable switches. Temporary cross-over switches for mine haulageways now reduce switch-installing time about one-half and obviate cutting main track. Turn-out and frog castings are hinged to bases bolted to the rails. In narrow headings the "cherry picker" seems to have come to stay. One type is operated by compressed air, using a single cylinder to raise the empty car high enough for loaded cars to pass beneath. One light-weight "cherry picker" is so compact that one man can move it about easily. Slusher loaders are also increasingly popular. Advantages have recently been noted in some block-caving camps as well as in sublevel caving operations. One installation has practically eliminated accidents due to unblocking hung-up raises.

A 2-cu.yd. placer shovel designed with special high-lift features works a 45-ft. bank to a 120-ft. width without difficulty. Reach permits shovel to stand back out of danger and rake the bank with dipper door open. Use of a cylindrical dipper handle, free to roll in the saddle block, eliminates torsional stresses. Crowd action is rope-applied to extreme end of dipper handle, and two separate, two-part hoist ropes lead over twin-point sheaves.

The amplidyne generator has introduced a fundamental change in shovel-generator control, providing smoother, more powerful performance, increased output, and decreased maintenance. It responds almost instantly to changes in power input. Walking draglines are greatly assisted by this new form of control. The dragline is lifted and set down gently.

Small high-speed bulldozers for mucking and conveyor feeding in mines and stockpiles are entering the picture. These rubber-tired units may also find use in clean-up operations where large blades are unsuited. Band and block rubber tracks offer the possibility of smoother, less noisy, faster and longer-lasting tractor treads when more rubber is available.

One improved hydraulic control unit for tractor power take-offs is simple in design, eliminating pipes, fittings, and loss of oil. Magnets in the suction line keep metallic particles out of the oil supply. The wide range of tractor application to open-cut mining includes literally dozens of jobs formerly impossible or too costly to do. Tractor-hauled rooters are serving well for breaking up shallow layers of shale and hardpan. Difficulties of blasting such deposits are thus obviated. Front-end fixtures for tractor bulldozers are being successfully used in track shifting. Fast-traveling pulling units combined with pusher-service performed by standard 'dozer-equipped tractors are noticeably increasing the already economical wheeled scraper outputs in open cuts.

Time formerly spent in slitting dynamite may be saved by new types of cartridge wrapping. In general, a waxed paper shell is used, having spirally disposed lines of perforations located between layers of paper wrapping. Leakage of cartridge contents as well as entrance of moisture is thus prevented. When tamped, the cartridge unwraps slightly as the contents expands to fill the hole.

The general trend toward safety in blasting continues through greater employment of ammonium nitrate type explosives, Primacord detonating fuse, fireproofed bags for liquid-oxygen cartridges, highly improved technique in electric firing, and improved regard for missed holes.

Horizontal-type drills employing large augers continue to make important progress in soft-material operations. A horizontally disposed charge is said to give better blasting results than vertical holes in open-pit banks.

It does not tip the bank over into the pit as much as the vertical charge does. Deep-hole wagon drill work is improved by more positive blowing of air to remove cuttings; increased drill diameter and stroke permit use of larger bits. To reduce air-line losses and pipe requirements some are using portable air compressors placed near the drilling place. New light diamond drills have definitely entered long-hole underground operations.

With a view to increasing the life of now precious rock-drill parts, manufacturers are advocating more careful selection of lubricants. Oils of proper viscosity, film strength (8,000 p.s.i. or higher), possessing a desirable amount of saponifiable additive and free of acids or other corrosives, are advocated.

Arising out of recent extraordinary tunnel-driving records, a trend toward jumbo or multiple-type drill mountings for headings and other uses where many holes can be simultaneously drilled, is noted. In such places a mobile mounting should be at hand to facilitate multiple drill transport. The new mountings make holes easier to spot and easier to drill to exact angles and positions. Better drilled holes give greater breakage and lapsed time for drilling is reduced. Increased importance is being attached to automatic feeding, and improvement is noted in both the air-jack and gear-driven types.

Underground power distribution continues to attract attention. The ignition mercury-arc rectifier station unit can be made portable for use where required. The problems involved in employing high-voltage cable underground are: proper burial of cable, proper junction boxes, and proper armor and conduit. Armored cables using varnished cambric are now favored because of difficulties with rubber deliveries. A new combined rail-bond tester and voltmeter permits operators to check efficiency of bonding and ascertain voltage decreases at any point. The following advantages are created: machinery operates at proper voltage, losses are avoided from high amperage and increased power cost, and a notable increase is developed in the life of armature windings.

Many new maintenance problems are arising because of shortage of equipment and supplies. Attention is being paid to details formerly often avoided. Salvage of usable metal parts, better maintenance of haulage systems, and greater care in the employment of all machinery are notable. Manufacturers are carrying on excellent educational campaigns in equipment maintenance, to the lasting good of mine operation. Metal-spraying is being successfully used to salvage pump impellers, rings, pump shaft sleeves, armature shafts, and locomotive axles. Large savings in work costs and new materials are thus obtained.

From experience gained in welding flat mine-car wheels and the savings gained thereby, one operator now runs two new wheels with two welded wheels on the same car and obtains practically the life of four new wheels. Ore cars are being lined with concrete to save steel in one operation. In place of the customary $\frac{3}{8}$-in. steel plate, 1 in. of concrete is giving good results. Concrete also replaces both steel and rubber as launder lining. Discarded mill screening is used as reinforcing. Only slight wear has been noted in several months.

Excellent transit-type cranes for repair and construction work in open-pit truck and conveyor mines are available. Some are convertible to dragline or shovel of small capacity. All travel at speeds around 25 m.p.h.

One wheeled-scraper builder is equipping new units with "economy" tires (25 percent less crude rubber). Load capacity is not affected but working life is cut from 30,000 to 20,000 hours.

Fiber pipe supported in concrete used successfully in oil-well casing may offer a solution to some of the steel-pipe supply problems in the mining industry. Plastic pipe and glass pipe may find usage also.

Data to justify pressure preservative treatment of mine timber continue to accumulate. Conservation of steel in permanent mine installations is a current strong point in its favor. A new mine-timber lifting jack is being tried. It combines simplicity and light, high-strength materials to save time and labor in essential timbering operations. The jacks are used singly or in pairs to bring timber into place. Mechanical mining has resulted in extensive use of mine-roof jacks.

Practical benefits from the proper use of geophones, with sound amplifier and recording apparatus, is seen in determining pillar size and roof span. Portions of pillars in open stopes may now be removed with an accurate predetermination of safe roof spans. Additions to ore reserves may thus be safely obtained. Mineral composition and structure of coal-mine roof rocks is being given increased study as a step in preventing mine-roof falls. Rock-weakening changes in structure and composition brought about by exposure to air may possibly be reduced if dehydration and oxidation can be retarded. The goal is to obviate the danger of roof falls and the extra handling of slate.

In the matter of hydraulic mine fill, 2-in. pipes and hoses are handling 50 tons of solids per hour of high-density pulp without blocking or other annoyances. Sand fill of 100 percent (−80) mesh is successful in some operations. In one mine using dry stope filling through 16-in. drill holes an ingenious power wheel distributor is used. The material is deflected at the hole bottom by a curved slide, picked up by a power-driven bladed wheel and thrown fully 50 ft.

New face-shielding helmets with high visibility offer protection against flying particles as well as heat and gases. The full-visored helmet may be hooked to a compressed-air line by a flexible tube feeding through an air filter and reducing valve. Complete control and freedom of adjustment are incorporated. A new one-piece filter for face respirators now protects against an even broader range of dust and mist than former two-piece types. A new rubber lung can be strapped to the chest of a shock victim requiring artificial respiration; raising and lowering a handle gives gentle, natural assistance to breathing muscles until they regain the strength needed. Automatic hydraulically operated vises permit use of both hands for operating shop machines; vise control is with the operator's foot. A flexible steel sheet sandwiched between layers of high-grade leather now offers workman protection against foot injury caused by stepping on nails, etc. Truck haulage in open-cut mines has developed highly satisfactory rules for safe operation.

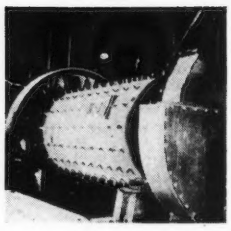
The mine ventilation problem has grown. Blower fans now alternate exhaust and blowing operations through metal tubing to improve removal of fumes and insure proper supply of fresh air to tunnel headings. One newly installed system employs heavy-duty coordinated reversible blowers installed 9,000 ft. apart along the tunnel. Blowing and exhausting are timed to conform with outside temperatures and thus avoid fog conditions in the tunnel. This particular system cuts about twenty minutes from the drilling cycle and adds appreciable footage to the day's "push." Ventilation engineering is on the upgrade as an aid to economic and safe mining. Ventilation surveys have become all important as economic measures to save fan power costs and provide needed adjustments.

Turbine-type pumps are increasing in popularity for unwatering old mines and in unwatering virgin ground preparatory to sinking. A drill hole located near the shaft site proves increasingly popular as a pump location for dewatering during sinking.

Cable-tool core-barrels are finding increased use in mineral exploration. Their use is new in several places. On the regular cable rig these coring tools are saving the time needed to bring in diamond drills for core recovery.

MINERAL DRESSING

New applications extend beyond customary field. Improvements made in unit processes and flotation of non-sulphides



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WHEN THE FINAL HISTORY of the war expansion of mineral production can be written, it will be found that improvements in mineral-dressing techniques, development of dressing processes for new ores, and rapid transitions from laboratory testing to successful mill operation have made a major contribution. Special credit should be given in many instances for the increased production obtained with existing facilities. However, for every problem solved many important projects remain in all stages of laboratory investigation.

Pressure to get things done in the most effective way, regardless of tradition and past practice, is giving the mineral dresser an entrée to a growing number of industrial operations having little or nothing to do with ores or minerals. Many breaks have appeared in the partitions formerly separating the fields of mineral dressing, process metallurgy, and chemical engineering.

Separations of one substance from another, without changing the chemical composition of either during the separation, are found as essential steps in all fields of industry. The separation apparatus and its operating principles are the same, with only minor variations, whether the substances involved are minerals, water, and air as in mineral dressing, or other solids, liquids, and gases. In the past there has been a division of the field of separation operations between metallurgists and chemical engineers, depending on the materials being handled, with the separation operations being considered an incidental part of each field. Furthermore, there has been a tendency for the metallurgist to observe the distinction between minerals and non-minerals and at the same time a tendency for the chemical engineer to ignore this distinction. Two possible outcomes seem to be in the offing.

I. Recognition of a separate branch of engineering, "separation engineering," "physical engineering," or otherwise named, dealing with separation operations not involving chemical change for minerals and non-minerals alike. This amounts to a broadening of the scope of mineral dressing.

II. Separation operations on minerals and non-minerals alike to be considered an incidental part of the field of chemical engineering. This is likely to be the chemical engineer's answer.

Unit Processes

COMMINUTION—The primary and secondary crushing plants at the new Morenci plant have been well described (*Min. & Met.*, May, 1942). The designs show the extreme simplicity which is the hallmark of thorough study of every detail before construction. Among the features is the dust-control system, which is "built in," according to the basic conception that "the control of dust in a milling plant should be an essential part of the process itself and not something to be tacked on later after the plant is in operation."

Ball milling continues to resist efforts really to understand it. The fact that certain procedures give the best results in one plant does not mean that the same procedures will work best elsewhere, and caution is shown both in drawing and in accepting conclusions regarding general principles. Specification of the pulp density, specific gravity of the ore, and sizing analysis is recognized as giving an incomplete description of the pulp in the ball mill, and technicians are feeling their way toward an understanding of the hydraulic properties, viscosity, state of dispersion, etc., and their relations to grinding action. There also seems to be a need for a more fundamental understanding of the action of the classifier and a clearer distinction between the effect of the classifier and the effect of the ball mill on over-all grinding results.

Several years of study at the Tuscaloosa station of the Bureau of Mines have led to the development of an ingenious apparatus for measuring net energy input (*Contrib. 127-F*, A.I.M.E.) in grinding coal. This apparatus is of interest not only because of the novel method of excluding friction losses from the energy measurements, but also because it is a continuous, closed-circuit device which can be operated to give substantially the same product as a commercial pulverizer. With materials as heterogeneous as coals, these features are of particular value, because the grinding characteristics vary considerably with both method of grinding and fineness of product.

There is still an open question as to the best means for measuring surface area of comminution products. At present, calculations from sizing analyses (including sedimentation analyses of subsieve material) are preferred by many because they give reliable figures of known limitations, and because the sizing analyses themselves are significant. In grinding cement, surface measurements by the standard turbidimeter method are routine operating guides. The Emmett method of surface measurement, based on the van der Waal's adsorption of nitrogen at low temperatures, is being applied in comminution research at M.I.T., and indications are that it represents a definite step forward.

SIZING AND CLASSIFICATION—Mechanically vibrated screens, using rod decks, are being used for very coarse screening where formerly stationary grizzlies were standard.

Though fine screening is rare and uneconomical in dressing ores, it is common in preparing abrasives, certain industrial minerals, and chemical products. The Rotex screen and other screens with oscillating motions mainly in a horizontal plane predominate in these fields.

It is still hard to realize that relatively sharp micron sizing can be carried out commercially in apparatus as simple as the hydroseparator. Sometimes it appears even easier than making the corresponding separations in the laboratory. Size separations in the subsieve range, using both hydroseparators and continuous centrifuges, are taking a variety of industrial operations out of the state of babying small batches of material through erratic elutriation devices and batch settling tanks.

GRAVITY CONCENTRATION—Pre-concentration by sink-and-float, heavy-media processes has continued to gain momentum. Use of sink-and-float to increase capacity of existing plants and to make possible the treatment of lower-grade ores should be counted as one of the mineral dresser's best answers to war demands for increased production. Continued efforts are being made to treat finer feed, and it seems likely that material as fine as 1 mm. may be concentrated.

Gravity separation plays a major rôle in recovering tin from Sullivan tailings. Of particular interest is the use of multi-deck tilting frames, operating automatically on five-minute cycles. The concentration principle involved is well known, but its application to this finely ground, very low-grade material was made attractive by clever engineering.

MAGNETIC SEPARATION—"Magnetic Separation of Ores," by R. S. Dean and C. W. Davis (Bull. 425, U.S.B.M.), is an up-to-date and complete reference book on this unit process, covering theories, laboratory testing methods, researches, patents, machines, flowsheets, and operating data, all in much detail.

ELECTROSTATIC SEPARATION—The program of investigation of electrostatic separation at the Bureau of Mines College Park station is dispelling much of the mystery which has surrounded this process. This work is particularly creditable in that its objective is not merely a qualitative understanding of the phenomena of electrostatic processes but also a quantitative formulation of all the physical variables involved and their relations to one another and to the selectivity of separation. Such an approach can be profitably applied to other mineral-dressing processes.

An interesting byproduct of Fraas and Ralston's work is the electrostatic grading of ground mica according to bulk density. Their data show such grading to be superior to grading by air or water elutriation, or pneumatic tabling.

FLOTATION—A large amount of flotation testing has been done, much of it on non-sulphide ores and industrial minerals which hitherto have not been investigated more than superficially. Though the final outcome cannot be reported at this time, there is no question that this intensive work is bearing fruit.

Further work on the physical chemistry and colloid chemistry of flotation has been reported. Sutherland has contributed the tenth of the "Principles of Flotation" series from "down under," dealing with the effect of added zinc, lead, and silver ions on the xanthate flotation of the common sulphides. This work emphasizes the important part which may be played by accidental activation with dissolved ore salts, completely changing the reagent response of the sulphide minerals.

A study of the activation of quartz with barium chloride (Gaudin and Patron) has shed light on the mechanism of activation. It was shown that effective flotation of quartz requires a 1:1 molecular ratio of oleate to barium. This would be expected with the barium using one of its valences to hang on to the quartz crystals and the other valence to hold the oleate group. On the other hand, formation of the compound $Ba(Ol)_2$ at the surface would call for a ratio of 2:1. A significant feature of this work was the consideration given to the crystal chemistry of the mineral and its relation to the adsorption phenomena.

Bankoff has obtained further information on slime coatings which cannot be satisfactorily explained by the chemical-cement theory advanced a few years ago. His data and earlier published data are correlated in terms of the analogy between slime coating and flocculation of the slimes.

The use of radioactive tracer methods, so successful in other fields, has been started in the study of flotation chemistry.

Dasher, Norman, and Ralston have experimented with the sticky-surface concentration of gravel-size minerals and have made several improvements over the technique originally described by Bierbrauer. If need arises for a process of separating 10-mesh to 2½-in. minerals, and other established processes cannot fill the bill, this method affords a possible solution.

Another new application of flotation principles in an unusual fashion is the conveyor belt "flotation machine," invented by Greene and Wilbur, and being used to recover phosphate from the débris or washer tailings of Coronet Phosphate Co. (*E.M.J.*, Dec. 1942).

ORE MICROSCOPY—As the mineral dresser meets new ores and milling problems, he continues to borrow microscope techniques from other fields and to adapt them to his needs. Once a low-power binocular microscope was adequate in the laboratory. Then the metallographic microscope and accessory sample preparation facilities became necessities for the study of polished sections and the briquetted mill products of sulphide ores. Increased attention to the dressing of non-metallic minerals called for the thorough use of the petrographic microscope. The Ultropak microscope has been found helpful in the examination of slime coatings, or loose grains too fine for the binocular microscope, and a few mineral dressers are even getting interested in the electron microscope.

A new tool in mineral identification described by Gutzeit (*E.&M.J.*, Nov. 1942) consists in making contact prints of the polished mineral surfaces. Its chief limitation is that it involves no magnification and thus will not distinguish the components of very fine ore structures.

Details of an unusually interesting microscope study of psilomelane and its occurrence in Cuban manganese ores have been reported by Gaudin and Spedden (*Min. Tech.*, May 1942).

With ores of any complexity, fractionation is usually necessary as a prelude to identification of the component minerals and as an aid to quantitative mineragraphy. Sizing and sink-float usually represent the first steps. The Haultain superpanner has proved its value in this work. More recently the Frantz isodynamic magnetic separator has been found to be valuable for this purpose, in separating sulphide and other minerals not commonly thought of as having magnetic properties.

New Applications of Mineral Dressing Processes

METAL PRODUCTS—Shortages in some of the metals, particularly those going into alloy steels, have led to the investigation of methods of beneficiating cuttings, grindings, and sweepings. Magnetic separation, dry or wet, is particularly applicable to ferrous materials. Gravity concentration, electrostatic separation, and flotation are also being used on a moderate scale, with promise of expansion. These applications are of special interest to mineral dressers in several ways: They may involve materials of high unit value (compared to ores). High-purity concentrates may bring a premium. Particle shapes may play a large rôle in the behavior of the materials during concentration.

Some consideration is being given to the recovery of metal losses in slags, drosses, and related products by concentration. Laboratory techniques and facilities used by the mineral dresser for studying the structure and liberation of ores are useful in analyzing the causes of these losses and in finding the means for reducing them.

Manufacture of metal powders for pressing and for use as pigment involves unusual comminution problems. It is interesting to note that the power used in producing 400-mesh bronze pigment is of the order of 0.85 kw. hr. per *pound*, which may be compared with the 5 to 10 kw. hr. per *ton* in grinding ore to flotation size.

The Wulff process for gilding metal scrap is an interesting example of combining chemical and mineral dressing operations. This scrap is sheet iron, with a gilding metal coating on both sides. The copper, zinc, and iron are liberated from one another by high-temperature chemical attack, followed by quenching and mechanical comminution. Most of the iron is recovered in relatively pure form by screening, the zinc is volatilized, and the remaining copper and iron oxides

are partly reduced and then separated by mineral dressing methods.

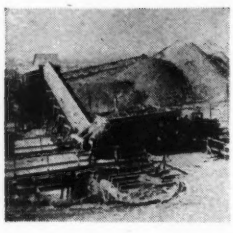
PORTLAND CEMENT—The Breerwood process for the flotation of cement rock is no longer a novelty. Likewise, wet grinding with ball mills in closed circuit with classifiers, following long established ore-dressing practice, is proving its value in a field long dominated by dry grinding. These innovations having served perhaps as the opening wedges, a variety of other mineral-dressing operations are being introduced, allowing the cement manufacturer to produce tailor-made blends from ordinary raw materials. These operations include: (1) the removal of graphite by flotation ahead of the limestone flotation; (2) gravity separation of silica, iron oxide, and alumina-bearing minerals after the limestone flotation; (3) flotation, using cationic collectors, of the tailings from the limestone flotation to separate mica; and (4) centrifugal sizing for fine-size separations, as a means of eliminating clay and of desliming before flotation.

FLOUR MILLING—The Earle process is used to separate the indigestible hulls from wheat kernels. The hulls are liberated by agitation with water and separated by flotation.

OIL SANDS—The oil sands of northern Alberta, Canada, contain an enormous reserve of oil, although only a small part is workable under present economic conditions. These sands are essentially unconsolidated quartz sands with the oil occurring as films on the sand particles. The oil content may be as high as 20 to 25 percent by weight. In the Abasand development, these sands are mined and conveyed to a separation plant. The "ore" is pulped with hot water, which liberates the oil from the quartz. The pulp is delivered to a special "Quiet Zone" flotation cell, in which the oil is froth-floated away from the sand. The froth product is diluted with naphtha and settled, to yield a diluted crude containing less than 1 percent each of water and of mineral matter.

SEWAGE TREATMENT AND WATER PURIFICATION — This large field is one in which much work has been done by specialists but which deserves the mineral dresser's careful attention. Of particular importance are studies of the flow of suspensions in open channels based on the modern theory of turbulent flow. These studies are leading to the understanding of the vertical distribution of solids in the flow and to the understanding of the mechanisms of pick-up and deposition at the bottom of the flow. Direct applications to launder design and settling problems are apparent.

Iron Ore Beneficiation



New plants boost tonnage of concentrates won from lower-grade deposits. Research programs under way. Taconites studied

L. J. Erck *Assistant Metallurgist, Butler Brothers, Cooley, Minn.*

DECEMBER saw the end of a record shipping season in the Lake Superior district. Tonnage sent down the Lakes during 1942 was much greater than that in 1941. The estimate for 1943 shows that further increase is anticipated.

Properties that have been lying idle are being investigated. The governing factors are the fixed price of iron-ore concentrates and the grade of concentrates that can be produced from a property. Mining and milling costs are leading factors in determining worth and feasibility of operation. The operator must also keep in mind that furnace requirements are unrelaxed.

Direct-shipping ores continue to make up the greater part of total shipments. As the tonnage increases, the proportion of wash ores and crude ores that require more complex treatment increases. This can be done only by building new concentration plants or increasing the capacity of existing ones. Simple screening and crushing plants are not included in this category, as ores thus beneficiated can still be classified as direct-shipping.

If possible, the operator limits the beneficiation operation to that of the straight washing plant which generally incorporates in its flowsheet two screens, a cone crusher, and either a spiral- or rake-type classifier. Four such plants have been installed.

Late in the season, a ferrosilicon heavy-density plant with the now conventional equipment was started and had only a two-weeks' run. According to its flowsheet, after the crude ore has been prepared in a straight washing plant, it is stockpiled. When brought into the heavy-medium plant it is first screened at ⅜ in. The minus 1¼-in. plus ⅜-in. material is separated into concentrates and tailings. The minus ⅜-in. size is washed in classifiers. Thus there are now three heavy-density plants in the Iron Country, two on the Mesabi and one on the Cuyuna. By next season a fourth unit will be installed in a plant where the crude ore is no longer amenable to straight washing treatment. Its flowsheet will be similar to the others.

Many changes have been made in existing plants, varying from small alterations to major replacements. New ideas and improved equipment, such as screens, classifiers, jigs, and conveyor systems, have been introduced. Activity is at a peak so high that it is difficult to make a thorough survey of current activities.

The large manganese leaching plant proposed for the Cuyuna Range is not now under consideration. The Cuyuna will continue to produce spiegel-grade and other low-grade manganese ores. Dormant properties on this range have been reopened. Plant building is not as extensive as on the Mesabi. One new installation was started in 1941. It can be used for crushing only, for straight washing, or for jigging, or for all three.

Most of the plants recently built or those under consideration have been planned with the idea of short-time operation and minimum expense. Once the demand for iron ore from the ranges drops back to normal, some of them will be shut down.

If the ore requirements from the Mesabi are continued for several years to come in order to complete the armament program and possibly for the post-war period, the reserves of direct-shipping ore will be reduced to a point where the concentrating ores will have to be relied on more and more. Already research programs to study the problems involved in treating the leaner ores have been started. The leading iron-ore producer on the range has had a research laboratory in operation for several seasons engaged in studying the several methods of concentration. Test work is carried out on a pilot-plant basis.

The past year saw two more research laboratories built for investigating the development of low-grade ores. One of these has been set up for studying the concentrating characteristics of taconites, both magnetic and non-magnetic. Froth flotation and magnetic concentration are the principal ore-dressing methods used. At present the work is limited to making batch tests on small-scale ma-

chines. When the initial phase has been completed to permit determining what type of flowsheet to use, an addition will be made to the present laboratory. The new section will house a pilot mill capable of treating a tonnage large enough to establish the milling cost.

The taconites that are being examined are mostly from the eastern section of the Mesabi. The iron in them occurs principally as magnetite. For this reason, magnetic concentrations would appear to be the most applicable. In cases, however, the taconite contains both magnetite and hematite. In such instances the tailings from magnetic concentration would contain the non-magnetic hematite, which would have to be recovered by froth flotation or some means of hydraulic concentration. This problem has been encountered before, in the case of the magnetic orebodies of Black River Falls, in Wisconsin, as well as at some of the magnetic-ore properties now being worked in New York State.

The latest research laboratory to be built on the Mesabi is equipped for several kinds of concentration. The material to be tested will include taconites, tailing-pond fines, and heavy-density plant tailings. These tailings contain values that can be concentrated. The problem is to determine if this can be done economically. Equipment in the new laboratory for processing the material includes a pilot heavy-density unit, a concentrating table, a Harz-type jig, a froth flotation cell, a ball mill, an Akins classifier, crushers, screens, driers.

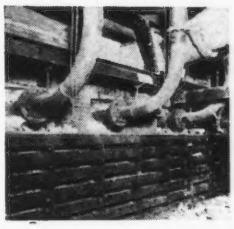
Also handled is current work including washing tests on churn-drill holes and concentration tests on lean-ore materials that are under consideration for possible production.

Work on low-grade ores will continue after the abnormal demands now being made on the Lake Superior region have been reduced. Necessity will require it so far as the operators whose reserve holdings are not too extensive are concerned. Programs of this type should have been started before, but prevailing tax conditions have not been favorable.

The Mines Experiment Station at the University of Minnesota continues to promote the development of the mineral resources of the State. Publicity is already being given the project under way there.

The life of the Lake Superior District and its ability to remain the leading producer of iron ore will depend on the ingenuity of its engineers. If the problems at hand are solved successfully and the price of iron ore, together with taxes and royalty fees, is adjusted to encourage this work, the shadow of ghost towns will be removed for many years to come.

Copper Metallurgy



New Morenci smelter blown in early in year. Theoretical and experimental aspects of converting are discussed

Ettore A. Peretti *Assistant Professor of Metallurgy, Columbia University, New York*

ALTHOUGH many copper camps in the United States and Canada had to contend with their first labor shortage in years, most of them managed to keep production at high levels, in some operations achieving record outputs. The new metallurgical plants at Morenci started production on Jan. 30, 1942. Most of the May, 1942, issue of *Mining and Metallurgy* was devoted to a description of this development.

J. C. Kinnear and Leonard Larson report that Nevada Consolidated's McGill smelter was operated at maximum capacity in 1942 and that blister output was materially increased over the previous record year of 1941.

Early in February a direct-fired preheater for preheating part of the air used for burning pulverized coal in the reverberatory was placed in service. This is a Ljungstrom horizontal unit which is direct-fired by tempered gases from coal burned on grates. Control is automatic, and the preheated air is mixed with the primary coal-air mixture in the burners. Preheated air from this was used during February, March, April, and May to increase the furnace smelting rate.

During the early months of the year the average moisture in the concentrate was about 9.2 percent. It was so wet that it was hard to charge, and contributed to irregular operation and explosions within when charging. This led to experiments to decrease the moisture in the filter concentrate. Introduction of superheated steam (about 450 deg. F.) into the filter feed and heating the feed to about 160 deg. F. allowed reduction of the moisture in the cake from about 9.2 to 7.2 percent.

This reduction permitted the furnace to smelt tonnage requirements without preheated air. The low moisture also resulted in lower pulverized-coal requirements and improved fuel ratios.

A Multiclone for recovering metal values from converter gases was placed in service in November. The installation consists of four units, each with 45 16-in. tubes. The gases are drawn through the units by a fan having water-cooled bearings and driven by a 150-hp. motor. Temperature of gases entering the units (operating three converters) averages 550 deg. F., and automatic control maintains a draft of 0.75 in. of water at the inlet. Stack temperature averages 350 deg. F., and stack draft 1.25 in. Temperatures and drafts are lower with only two converters operating.

Four units were installed to handle the gases from three converters. It appears that three units may be sufficient, giving a spare for emergency. Only two have been required with two converters operating.

Dust is removed from the hoppers under the Multiclones by 12-in. screw conveyors, and delivered to a 24-in. conveyor belt by an inclined Redler conveyor. Dusting at the junction with the belt is eliminated by venting the housing to the flue. The dust is sprayed with water along the belt and mixed during its passage along the belt by rubber angle scrapers, which turn the material over and over. The dust product, just moist enough to keep from dusting, is delivered to the concentrate charge daily. This is proving simpler and more satisfactory than the pug mill used on dusts from the Cottrell plant.

Dust recovered to date averages 38 percent copper, giving a concentrated product and improving recovery.

An economizer was completed in December, which will recover about 50 percent of the heat units in reverberatory gases after they leave the waste-heat boilers. They leave at about 650 deg. F., enter the economizer at 625 deg. F., and leave it at 300 to 350 deg. F., depending on conditions and the possible corrosive effect of low-temperature gases on the Cottrell plant. The economizer will increase waste boiler plant efficiency.

No. 2 furnace, aided by a new refractory spraying technique, had completed 488 furnace days on Dec. 1, 1942, without a shutdown since the previous shutdown for refractory repair. The method used in maintaining the lining is as follows: Benton-

ite is mixed in water by air agitation to a relatively stiff gel, containing about 90 percent water. To this, silica flour (about 95 percent minus-200 mesh and 98.5 percent SiO_2) is added and mixed in a rotary mixer. On a dry basis the mixture contains 6.5 percent bentonite and 93.5 percent silica flour. The final product for spraying contains 40 percent water and has a stiff plastic consistency. As measured by a modified Stormer viscosimeter, this consistency has a shear point of about 1,200 grams. The plastic mixture is sprayed on the walls and roof uptake, flue to boilers, and boiler pilasters by means of a Quigley gun and a water-cooled spray pipe. The latter must be water-cooled for points several feet within the furnace, because of the stiff mixture. A large percentage of the refractory mixture adheres to the furnace lining and does not spall off. The lining can be built up to any thickness by successive applications. The renewed linings are very refractory and of a cellular texture, weighing about 35 lb. per cubic foot. This texture provides protection and insulation.

According to Frederick Laist and W. E. Mitchell, the following improvements have been made at Anaconda, Mont.: The East mill of the copper concentrator has been remodeled to give a simpler flowsheet. Ore crushed to 1 in. is roll-crushed in one stage to ½-in. and then ground to 7 percent plus 65 mesh in Hardinge mills in closed circuit with 72-in. Akins classifiers. The product of the ball-mill circuit from four grinding sections is brought to a central point and mechanically distributed to twelve No. 48 12-cell Agitair machines.

The East mill flowsheet supplants one consisting of four separate concentrator sections in which the ore was roll-crushed in three stages from 1 in. to 2 mm. for ball-mill grinding and then floated. The roll-crushing and grinding circuits have been simplified and the elimination of four individual flotation units provides for more uniform flotation.

A new converter plant was installed in 1942. Consisting of four 13x30-ft. Peirce-Smith converters, two barrel-type, 13x27-ft., casting furnaces, and a 40-ft. casting wheel, it is situated immediately below the reverberatory furnaces and supplants the old converter plant of seven Great Falls converters, three brick casting furnaces, and three anode casting conveyors situated some distance from the reverberatories. The layout reduces the tonnage of cold reverts to be handled.

At Hudson Bay's Flin Flon plant the year was one of record production, according to J. H. Ambrose and W. A. Green. This was made possible by enlarging the reverberatory smelting zone, and adding another roaster. The smelter now has five 10-hearth Nichols-Herreshoff roasters, one reverberatory, and three 13x30-ft. Peirce-Smith converters. Reverberatory capacity is more than 1,500 tons of solid charge per furnace day.

A new roaster flue of steel was built at the same time as the fifth roaster. It is on the opposite side from the existing flue. All roasters are connected to both flues. This has improved draft conditions and control.

Air used for cooling the center column and arms of the new roaster discharges to the inlet of an electric air preheater, and thence into the roaster as combustion air. This provides hotter air with a lower power consumption than when atmospheric air is piped into the preheater.

Reverberatory capacity was increased by widening the smelting zone 2 ft. 9 in. on each side for a distance of 60 ft. from the burners. New buckstays were installed on 8-ft. centers and new side walls built flush with the old walls to just above the slag line. This was done under full operation, and included the provision of new matte tap-holes in the widened portion. The side walls are stepped back above the slag line to a thickness of 8 in. for the top 3 ft. of wall. Extension of the furnace arch over the widened part presented no difficulties, as the entire arch is of the Detrick-suspended type of construction. Noranda's staff assisted in the details.

At the Falconbridge plant, E. Craig and T. W. Cavers report a material increase in capacity of the company's No. 30 Denver Sub-A cells by introducing 10 oz. of air. In spite of the greater tonnage handled, power required has been reduced substantially from what it was without the air, and recovery has improved.

Aspects of Converting

One of the most important publications of the year on copper metallurgy is an article by A. Gronningsater and Peter R. Drummond in which are discussed theoretical and experimental aspects of copper converting. Whether or not one agrees with the authors' thesis, considerable food for thought is presented. The authors conclude as follows:

"1. Quantitative balancing of converting reactions necessitates the inclusion of the blown matte in the calculations. A cold converter does not form slag, but, instead, magnetite, which accumulates in the matte until the temperature reaches the point where normal silicates can be formed. When the contents of the shell become heated to (say) 1,230 deg. C. or over, silicates are formed, and gradually the magnetite, held in the matte layer, is taken up by the slag. This effect is not immediately obvious, due to stored magnetite in the matte, and a thick slag may be due to magnetite formed hours before. Proper temperature is the most important point in avoiding or minimizing trouble in converter operations from magnetite, such as magnetite accretions which tend to fill in the shell, thick dirty converter slags, etc. The more magnetite there is to contend with, the higher the temperature that is needed. Clean primary matte, low in magnetite, going to the converter, and silica well within the permissible limits in the converter slag, also lessen magnetite trouble.

"The necessity of including the blown matte in converter calculations greatly accentuates the difficulty in arriving at a true picture of converting. The shell contents (for example, after 24 hours of blowing) have to be calculated by a plus-and-minus method from the commencement of the operation. This leads to accumulative errors and makes an accurate oxygen versus sulphide balance impossible.

"2. Temperature control, within rather narrow limits, is the most important feature of good converter operations. Too high a temperature is hard on the lining. Too low a temperature results in magnetite formation and also lowers the oxygen efficiency 10, 15, and even 20 percent, thereby greatly lessening the heat available for smelting of cold fluxes.

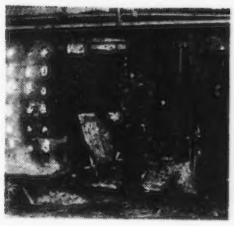
"3. In spite of the unavoidable high heat losses in the escaping gases, the converter is a fairly efficient thermal machine and a very substantial part of the total net heat available from the reactions can be expended on smelting of cold fluxes.

"The main object of converter operations is, of course, the production of metal or (in the present case) high-grade matte. The original application of bessemer converters to this purpose enabled it to be done without fuel. The next step in the evolution of converting is scientific control, and utilization of as much of the heat as possible for the smelting of ore fluxes.

"We believe that the possibilities of economic advantages from use of the converter as a smelting machine have not been fully appreciated. A considerable flexibility in composition of matte, fluxes, and converter slag is possible. We believe that when all factors entering into converter operations are studied, understood, and given proper consideration, it will be found that there is much more flexibility possible in operation to meet varying conditions than generally has been assumed. If matte, fluxes, and air, going to the converter, were controlled and balanced with the care and accuracy used in many other furnace operations, and maintenance of correct temperature were given proper attention, a much greater tonnage of valuable fluxes might be smelted, with no cost for fuel, than has heretofore been considered possible."

In closing I wish to thank the men of the various copper plants who so kindly gave of their time in furnishing the information presented in this review.

ZINC METALLURGY



New electrolytic plant uses flash roasters, batch leaching, double filtration ahead of cells. Metal from re-treatment of residues

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THE ZINC INDUSTRY in 1942 had two major features: the urge for primary production, and the conservation of metal by substituting other materials or by stopping the manufacture of articles containing zinc.

Allocation of zinc to the war program grew from 31 percent at the beginning of the year to almost 100 percent by July.

Primary production was stimulated early in the year when Metals Reserve Co. announced a price of 11c. per pound for new metal produced by companies in excess of their 1941 production. The premium became payable also to mines which were not in operation during the previous year and to new mines, but not for production previously arranged by specific agreement with controlling boards.

The OPM established a separate zinc section of the War Production Board—this providing more specific action with respect to the metal. The section's function was to ascertain the location of excess inventories of various grades of zinc scrap and to direct this material into war production.

Also early in the year the Secretary of the Interior submitted to the Senate subcommittee investigating the use of the country's resources a program for expansion embracing prospecting, developing, and exploiting low-grade ores which would be financed by the RFC. These explorations were made in a dozen or more districts, principally in the West.

In July the WPB announced its Zinc Conservation Order M11-b, prohibiting the use of zinc in manufacture of more than 100 items. This applies to zinc metal, new and scrap, and to zinc dust for sherardizing. It does not apply to zinc dust for other purposes, to zinc used for repair and maintenance, nor to zinc oxide.

Later WPB took drastic action respecting production of galvanized ware, reducing the number of sizes and kinds of ware from 150 down to a few. This made 10,000 tons of zinc available for the war program. After Jan. 1, 1943, a further reduction of 50 percent will be in effect.

For a period a paradoxical situation existed as a result of the reduced galvanizing operations. The immediate effect was to create for a time an oversupply of scrap zinc that formerly was delivered to the galvanizers. As new Prime Western zinc for the greatly reduced galvanizing operations was obtainable, it became no longer necessary to use remelted scrap. After this abnormality became apparent such scrap was directed into suitable channels of use.

In August the Board announced to publishers reclaiming plans whereby this group can have all the zinc necessary for newspaper pictures and other engravings and at the same time consume only a fraction of the metal previously used. This procedure involves segregation of zinc plates after printing and remelting them for re-use. By this plan, this industry lives on its own scrap.

Substantial gain in conservation of zinc was made when WPB prohibited the use of zinc closures for glass containers. This saved approximately 10,500 tons of metal during the year. Restrictions on dry-cell battery output saved an additional 8,000 tons.

The die-casting industry continues to use an increasing tonnage of electrolytic or other high-grade zinc. More than 125,000 tons was so used, equal to approximately 37 percent of the electrolytic metal produced.

As to new finds, the Federal Mining & Smelting Co. has reopened the Helena Frisco mine, in Idaho, down to the 200-ft. level. Crosscutting disclosed a vein of ore 3 to 4 ft. wide containing 7 percent lead and a higher tenor of zinc.

Substantial tonnages of tailing dumps in the Tri-State field were exploited. Similar work yielded 80,000 tons of concentrates in 1940, 86,000 in 1941, and may prove to have produced a similar or an increased tonnage during 1942.

Similar reclamation was made in the Coeur d'Alenes, in Idaho, by Hecla Mining Co. at a point where approximately 1,500,000 tons of dump material is available. A 2,000-ton sink-and-float plant has been installed for the initial treatment, which drops about one-third of the waste. The beneficiated product, assaying approximately 2½ percent zinc and 1 percent lead, is being shipped to the Polaris and Hecla mills for final concentration.

War activities in the Far East have cut off the supplies of zinc concentrates from Burma, amounting to 60,000 tons per year.

Productive capacity of the Anaconda electrolytic zinc plants in Montana was increased about 2 per cent.

A process for recovering indium has been further developed by Anaconda and additional annual quantities are now available. Purity is well controlled up to 99.99 percent. Indium occupies a unique position in that an exceedingly minute amount of it plated on some lead-base alloy bearing, followed by a short heat treatment, develops corrosion resistance to the lubricating oil. Here we have a relatively rare metal with an outstanding diffusion rate performing a commercial service.

In Idaho, Bunker Hill & Sullivan's plant for treatment of lead blast-furnace slag for recovery of zinc is nearing completion and promises to be ready early in 1943.

At the American Metal Co.'s Oklahoma smelter and the one in Pennsylvania and Langeloth, every effort is being made to increase zinc output. At the former, a Cottrell unit has been installed to collect cadmium fume from sintering. The cadmium dust is shipped elsewhere for final conversion to metal.

At the Pennsylvania smelter installation of a Waelz kiln is contemplated. Pending government approval work was to have been started late in 1942.

Efforts of American Zinc, Lead & Smelting Co. to increase output have been outstanding. The Jarnigan mine in Tennessee has been reopened, its production increasing the tonnage milled 25 percent over that of 1941.

The tonnage put through the Tennessee concentrator is substantially greater than that treated the previous year, but was handled in the regular flowsheet by increasing the efficiency of the sink-and-float process. The latter discards as a coarse tailing (⅜- to 2-in. sizes) 55 to 60 percent of the ore mined.

Three retort blocks, a sintering machine, and a roaster were added to the company's plant in Texas. By the end of 1942, this plant was to comprise 8 blocks of retort furnaces, 4 Ropp roasters, and 2 sintering machines. In addition, a cadmium re-

covery process has been put into operation there.

At the Illinois smelter, an additional 800-retort block and a small gas-fired block of 120 retorts for treating cathode melting furnace skimmings has been put into operation. This work provides 4,000 retorts for calcine.

A new flash-roasting furnace and a contact sulphuric-acid plant for making 100 percent acid has been built and will be in operation early in January, 1943. Another Waelz kiln plant with primary and secondary units has been installed for the treating of electrolytic zinc-plant residues and for densifying the recovered oxide. The increased amount of byproducts such as lead and cadmium recovered will be treated in the enlarged cadmium plant; also the reclaimed cadmium sponge from the purification precipitate in the Monsanto electrolytic division at Monsanto.

The capacity of the electrolytic division of the American Zinc Co. of Illinois has been doubled. Driers sufficient to handle the residues are being installed and the residues will be shipped to Illinois for Waelz-kiln treatment. Calcine for feed to the electrolytic plant will be produced in the new flash roaster now being installed at the plant mentioned and from the flash roaster which was started early in 1942 at the Titanium Pigments plant of National Lead Co., in Missouri. The bulk of the calcines are being produced from the Titanium flash roaster.

The electrolytic zinc plant built by the American Smelting & Refining Co. in Texas was started in September. Besides the high-grade zinc it will make mono-sulphuric acid. It employs approximately 300 men. The high-grade metal will be produced from zinc concentrates supplied from company mines, principally in Newfoundland and Mexico. A modern power plant has been built at the site, where electric power is generated with steam turbines using natural gas as fuel.

Batch leaching has been adopted for dissolving the zinc from the calcine, the latter being produced by flash roasters of Trail design. Revolving pressure filters separate the solids, which are washed in this filter, then discharged, repulped with water, and thickened. The spigot discharge is again filtered by vacuum filters. The dried residue is shipped to a lead smelter for recovery of lead and precious metals.

Purification and cell-room operations are of the conventional type adjusted to harmonize with plant conditions.

Solution circulation and cooling is accomplished with a system of large tanks, pumps, pipe lines, launders, and fan-cooled acid-proof towers.

In passing through the cells, the solution temperature rises; it is then returned to a storage tank, from which a portion is pumped back to the leaching tanks and the remainder is re-circulated through air-cooled towers similar to those used for cooling and evaporating pure solution, except they are acid-proofed.

With the various increased plant facilities provided for all plants producing electrolytic zinc, the capacity of the United States by the end of 1942 will be equal to 35 percent of the estimated tonnage for the year from all primary production, compared with 27 percent in 1941.

At its Oklahoma smelter, Eagle-Picher Mining & Smelting Co. is installing a Waelz kiln plant for treating retort residues. Three new blocks also were under construction late in the year. Both installations have been financed by Metals Reserve.

Salt is added to the charge on the sintering machines to assist the volatilization of cadmium, which is collected as dust in a four-unit Research Corporation Cottrell precipitator. The Cottrell dust is leached with dilute sulphuric acid for dissolving the cadmium. This solution, after filtration, is treated with zinc dust to precipitate cadmium sponge. Filtration follows, and the recovered sponge is briqueted, retorted, and cast into cadmium balls for market.

A pilot plant is in operation for producing germanium and a small amount of indium from some of the cadmium plant byproducts. Considerable germanium could be produced if it had a market.

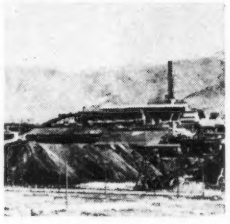
In Eagle-Picher's Central mill, the three conspicuous conditions in the present ore-dressing technique are: (1) Use of sink-and-float embodied in two cones. (2) The minimized use of jigs. (3) The absence of tables.

Two cones treat 84 percent of the mill heads. In former days roughing jigs treated 90 percent, whereas at present only 19 percent is so treated. Prior to installing the cones the roughing jig tailing assayed from 0.9 to 1.1 percent zinc. The sink-and-float cones reduce this loss 13 percent.

The objective of present research is to develop a practice that uses two sink-and-float circuits, an optional cleaning jig circuit, and a flotation plant. One sink-and-float circuit would treat plus-$\frac{3}{8}$-in. mill feed as coarse as possible; the other would treat minus-$\frac{3}{8}$-in. plus-28 mesh. The optional cleaning would operate according to the smelter's coarse concentrate requirements. Problems associated with the treatment of the minus-$\frac{3}{8}$-in. plus 28 mesh feed have not been completely solved; when accomplished, the objective will have been attained.

In Illinois, the Mineral Point Zinc Co. entered the list of active producers of high-grade zinc.

LEAD METALLURGY



Smelters, faced with shortage of labor and supplies, concentrate on metal production. Scrap iron scarce for furnaces

G. L. Oldright *Senior Non-ferrous Metallurgist, Metallurgical Division, Bureau of Mines, Salt Lake City, Utah*

LARGE PRODUCERS OF METALLIC LEAD in 1942 centered their efforts on production under handicaps of limited supplies, labor, and supervision. Steady improvements were recorded in technological and metallurgical programs already laid out. The smaller producers, particularly those selling some other commodities than metallic, have developed exceedingly flexible plants and personnel to meet the exceptionally variable market demands. Developments in concentration to handle ores containing minerals of several metals and ores of simpler types, but of lower grade, have been consummated. Consumption has been curtailed largely to conserve lead so that it may be substituted for other and scarcer metals. As a net result of all factors, lead has been the most plentiful of the war restricted metals.

Two large lead-zinc producers now make the first discard of barren material from their concentrators by using a high-density medium—a suspension of finely ground galena. R. E. Illidge outlined (Feb. 1942, St. Louis Meeting A.I.M.E.) the general conditions under which Eagle-Picher Co. had found it advantageous to install gravity cones in its central mill, which treats much

of the ore of the Tri-State district. About 90 percent of the mill feed in the district was jigged in rougher cells, and about 75 percent of the feed to the rougher jigs could be discarded as tailings containing approximately 10 percent of the values in the feed. The first feed to the gravity cone (or "sink-and-float") plant is essentially the coarse fraction from the screens of the Symons crushers, and is the same class of material that was coarse-jigged—one containing much gangue that may be discarded at relatively coarse sizes, richer feed being secured thereby for subsequent concentrating units.

Intermediate and finer sizes from the screens of the Symons crushers are jigged or floated. The first enriched "sink" product is reground by rolls and screened; the coarse fraction is re-treated in a gravity cone to yield tailings and a valuable product to be reground—this time in a ball mill to make flotation feed. Both the jigs and the flotation cells make final concentrates and tailings to be discarded. Bunker Hill & Sullivan has installed (*Mining World*, July 1942) the Huntington-Heberlein "sink-and-float" process ahead of the other units in its concentrator. By so doing, it increased the tonnage mined and crushed from 1,000 to 1,500 tons per day, discarded 35 to 40 percent, and raised the grade of the feed to the subsequent concentrating units to 12 percent lead. Tailing losses from the sink-and-float section "average somewhat less than for the final tailing."

Gravity vs. flotation

Concentrators in the United States have not, in general, adopted "all-flotation" flowsheets until forced to do so by the increasing intimacy of association and the decreasing size of grains of the valuable minerals in their ores; the gravity-concentration units have been retained until the proportion of the freed valuable grains recoverable as "clean," relatively coarse concentrates has been lowered to an uneconomic point. "Development of All-Flotation Process at Zinc Corporation, Ltd., Broken Hill," as recorded by M. O. Mawby with reference to earlier papers (Australasian I.M.M., Sept. 30, 1941), will be followed by all metallurgists interested in determining where concentration by gravity methods ends and flotation begins. Those favoring tabling, for instance, may feel less sure than Mawby that present gravity methods have been nearly perfected. The Zinc Corporation adopted its "all-flotation" flowsheet from choice, nevertheless, and not because of the over-fine size of the mineral grains. Some unusual features influenced its decision; the grinding operation and classification therefore were so developed as to avoid overgrinding. Very fine grinding is not necessary; the sulphides grind preferentially, and the Dorr classifier overflow, with about 13 percent of plus-60-mesh material, goes directly to flotation. The combined nature of all the minerals is such that no depressants for sphalerite are used in the galena flotation circuit; there is also not the usual dropping off in the recovery of lead from minus-200-mesh particles; 99 percent of the lead is floated from feed of this size. The minus-200-mesh fraction of the concentrate (81 percent of the total) contained 78.6 percent of lead, against about 77.4 percent for the total product.

During 1942, some producers of lead reported an increasing number of valuable mineral products sold as concentrates. Minerals so recovered included those of tungsten, molybdenum, and copper, in addition to the usual lead-zinc-silver products. Fluorite was also recovered, and other minerals may be expected. As ores of zinc, copper, and lead are sought with increasing intensity, more such complex occurrences may be developed.

Concentrate adjustments

In last year's review, it was noted that at Broken Hill the lead concentrate contained 75.3 percent of lead and the sinter cake at the Port Pirie smelter 47 percent, much of the diluent added to give the lessened lead content being granulated lead blast-furnace slag; 1.5 tons of total slag were formed per ton of new input lead to the furnaces, of which 0.5 ton was new slag. The Zinc Corporation 77.4 percent lead concentrate noted in the foregoing contained only 3.6 percent of zinc; the chief incentive (other than saving weight) in removing the zinc was, then, to introduce as much as possible of this metal into the zinc concentrate, as there is little advantage at present in making a richer lead concentrate for its own sake. Where there are advantages in so doing, some concentrators can grade up the major portion of their galena into a product containing over 80 percent lead. One concentrator has been able to approach within 1 percent the percentage of Pb in PbS. At present, however, from the tonnage standpoint, there is financially more inducement toward making a high-grade zinc concentrate for the retorts via the D. & L.'s than in making high-grade lead concentrates. It has been found that when chloridizing sintering is practiced, if the units are fed zinc concentrates containing less than approximately 0.6 percent of lead, zinc of "intermediate" grade can be made.

Eagle-Picher's lead smelter staff in Kansas modified the plant during the year to take more advantage of having the Scotch hearths for metallizing rich lead products and a D. & L. blast furnace unit to take care of lower-grade lead products. The sintering machine was altered to adapt it to sinter lead, as well as zinc, concentrates and other products. Direct smelting of Scotch hearth gray slag has been found a problem at some plants. Such material, though coarse in size, is highly basic even when well desulphurized, and these bases are not in intimate contact with silica. On being crushed, however, the gray slag, with the requisite siliceous and other fluxes, makes a good diluent for lead products too poor to form good feed to the Scotch hearth, yet overly rich to sinter directly.

Mechanical Scotch hearth

Sintering gives an adequate means of disposing of fine dust, and this material will carry the water needed for sintering without making a mud-like feed. The sulphur content of the combined sinter charge is such that good sinter is made in a single pass over the D. & L. In so far as meets the demands of the market and of other company units, the rich lead products are sent to the Scotch hearths. In cooperation with the Bureau of Mines, a process was developed for forming (preferably rich) lead flotation concentrates into hard, uniform pellets about the size of intermediate jig concentrates. If desired, the fuel used (coal) can be placed in the pellets in powdered form. These pellets smelt as rapidly as jig concentrates of the same percentage lead content. A mechanically fed Scotch hearth of standard size was built and operated satisfactorily even in weather so hot as to be severe to hand operators. With the Scotch hearth mechanically operated, units of larger size should be feasible, and the objection to the Scotch hearth as a small unit requiring much arduous hand labor would be overcome. A unit 60 percent larger than the standard size is being built.

An authority on lead smelting considers that the progress made in recirculating gases on the D. & L. machines is the most important completed development in years. At one plant, 75 percent of all the SO_2 is recovered as a 7 percent gas, which gives the acid, the sulphur, or the liquid SO_2 maker a good start. The improvement was brought about by very close control of the drafts in the windboxes and superimposed hoods and by securing a chemically and physically uniform feed of moderately high sulphur content. One plant has learned that by using simple shields the charge can be kept from accumulating on the rails, and the pellets thus prevented from "riding up." At a Texas smelter a 63-in. by 40-ft. D. & L. was installed, with very satisfactory results as to capacity and costs, including maintenance.

The scarcity and poor quality of the

Electrometallurgy

Light metal production grows tremendously as new plants are opened. Bayer process tailings may be potential aluminum source

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THE MAIN FEATURES of electrometallurgy in 1942 relate, as they have for several years, to the light metals, although practically all electrometallurgical plants were strained to meet the demands of the United States and other United Nations' war programs. The rate at which new or additional plant capacity was brought up to par was quite often dependent on the labor supply available. The U. S. Bureau of Mines announced a $500,000 electro-development laboratory to be built in the Northwest to study recovery and processing of minerals in the region supplied by Bonneville and Grand Coulee power.

ALUMINUM—Early in 1941 our desired production rate of aluminum was set at 400,000 tons per annum. In the second half of the year the figure was raised to 720,000 tons, and early in 1942, raised again, to 1,050,000 tons. The cost of increasing production by 320,000 tons was estimated at around $350,000,000. Canadian imports were set at 225,000 tons. These tonnages were considered as required by the demands of the revised war program including President Roosevelt's schedule of 125,000 airplanes in 1943.

The aluminum production rate actually achieved by the end of 1941 was a little short of 500,000 tons per annum. At the end of 1942 it has been estimated at 1,000,000 tons. It would appear that the production during 1942 was something over 500,000 tons.

Because of the difficulty in getting scrap iron now used by many lead smelters have caused some interesting developments. Some smelters treating highly arsenical material have found it necessary to remove much of the arsenic from the blast-furnace charge. Several plants with highly zinciferous charges have found that, by lowering the sulphur and thereby probably the PbS content of the sinter, they can increase the lime content of the blast-furnace slags and use less scrap iron. (The iron blast-furnace operator increases the quantities of both coke and lime in the charge, to metallize iron.) Those volatilizing zinc (and lead) from lead blast-furnace slags found that with the stronger base (CaO) present, the zinc volatilizes more readily.

Some blast furnaces have had to smelt richer lead charges than were desired, owing to the scarcity of siliceous ores containing "marginal" amounts of precious metals. Silver has now a higher ranking as a war metal, but gold has not, therefore such siliceous ores are likely to become still scarcer. Some metallurgists question if it is not necessary to form some minimum percentage of slag from a charge, and whether there is some optimum upper limit of lead content for good blast-furnace operation itself. Compilation of data covering 28 years of operation at one large smelter revealed, however, only that the quality of the sinter made was so much the predominant factor that the question will be difficult to answer in terms of blast-furnace capacity versus lead content of the sinter alone. Sinter from overly rich lead charges is not sinter from, say, a 40 per cent lead charge to which metallic lead has been added, but is material of considerably different chemical and physical nature.

Bunker Hill & Sullivan built a slag-treatment plant, following in general the flowsheet of the three plants already in operation in British Columbia, Montana and Utah but profiting by their operating experience. P. C. Fedderson stated (*Min. World*, Jan. 1942, p. 29) that the plant will treat the current production of hot blast-furnace slag (about 200 tons daily) and 100 to 200 tons of cold slag from a dump containing about 1,000,000 tons of 10 percent zinc. It is expected that it will produce about 50 tons of fume daily containing 30 to 35 tons of zinc and and 5 tons of lead.

Among the newer features should be noted the care to insure that a constant mixture of powdered coal and air will enter the specially designed tuyeres along the sides and 5½ in. above the bottom of the 15x8-ft. water-jacketed furnace. The temperature of the fume-laden gases leaving the furnace will be reduced from about 2,200 deg. F. to 200 deg. F. in waste-heat boilers before they are filtered through woolen bags. The bags will be shaken automatically; and the dusts will be conveyed by screws and belts, rather than pneumatically, although this latter system was worked out elsewhere after some initial difficulties. The combined fume will contain chiefly oxides and sulphates of lead and zinc, but also some unusual elements found elsewhere to make it necessary for electrolytic plants to add extra purification steps. As the Sullivan Mining Co.'s electrolytic zinc plant is already operating at capacity, the mixed fume will be deleaded at about 2,100 deg. F. in a kiln, and a product containing 70 to 75 percent of zinc and 1 percent of lead will be shipped to a zinc-retort plant. Possibly some sodium chloride or zinc sulphide will be added to the deleading kiln; by using salt it is possible to volatilize the lead at lower temperatures and so save the kiln lining, but chlorine and its compounds are destructive to steel work and bags.

J. B. Huttl (*E. & M. J.*, Vol. 143, p. 56, Nov. 1942) discussed Bunker Hill's new concentrator to recover siderite ($FeCO_3$) for flux and some galena from old tailings. The siderite is recovered by gravity methods, and a flotation "galena unit" was to be installed. The siderite concentrates contain about 34 percent of iron to 17 of insoluble, about 5.2 oz. of lead, and 2.5 oz. of silver.

Some of the lead smelters are using soda flux in their lead-dressing reverberatory furnaces. A small amount of soda ash with a little coke dust gives them copper speiss with a much higher copper : lead ratio and bullion that contains less copper; the furnace capacity is greater; and the consumption of fuel is less. Another lead smelter has recently added a dross reverberatory to help handle its large amount of copper and now finds it unnecessary to add raw sulphides to the blast furnace to take out the copper as matte. The drossing furnace produces a "matte-speiss," containing 40 to 50 percent copper and 12 to 18 percent lead, that can be blown directly to blister in the converters. With less sulphur in the blast-furnace charge, as already stated, more lime can be used, and less scrap iron is required. It has been noted that another smelter has found it advisable to roast more arsenic from the blast-furnace charge to decrease the amount of speiss made. Another finds it helpful to segregate the blast-furnace dust from that made by the D. & L. to recover cadmium more readily.

the required additional powerhouse equipment, it was decided to build the plants of the last enlargement, with total capacity of 320,000 tons metal per annum, in large industrial centers, and use the standby electrical power available at such places. One would hardly expect much of this new capacity to operate under normal market conditions after the war, because of the relatively high priced power these plants will use. One such plant is in New York State. It will have a capacity of 130,000 tons metal per year and was built under the Aluminum Co. direction. The average power cost has been estimated at 5 mills per kw.-hr., as against an average of 3 mills near hydroelectric developments. Construction cost estimate was given as $14,500,000. The plant was to consist of 28 one-story buildings covering 90 acres, and the operating force set at 3,500 men. Excavation was begun in the middle of the year and the plant started up before the year's end.

More new capacity

In May the Defense Plant Corp. announced construction of a 50,000-ton plant in the San Joaquin Valley of California which is to use power developed for the Bay Region. Construction costs were estimated at $12,000,000. Three plants in Oregon, Washington, and New York were started up in May, and one in Alabama was begun in June. Three more, in Arkansas, California, and Washington, were started up in July. The last seven constitute the group of government-owned plants projected in 1941 to raise the capacity from 400,000 tons to 720,000. The phenomenal records for construction of aluminum plants have been partly due to standardizing buildings and equipments as much as possible, according to T. D. Jolly, chief engineer. From one set of shop drawings 72 buildings were erected. At one plant, where steam-driven turbo-generators were not available and cheap natural gas was, 18 gas engines were installed to drive an equal number of 2,250-kw. d.c. generators, and 60 gas engines to drive an equal number of 750-kw. d.c. generators. These sets eliminate the cost of transmission lines, transformers, and mercury arc rectifiers normally required.

The Bayer process applied to high-grade bauxite remains the most desired basis of alumina operations. However, the huge expansion of metal-producing capacity, the somewhat limited domestic high-grade bauxite deposits, and the desire to free the shipping required for bauxite imports, have made advisable the utilization of lower-grade materials in the United States. The program started is to make the country independent of foreign deposits by May, 1943, and able to supply Canadian bauxite needs by September. The dividing line between low- and high-silica bauxites has been raised in the last few years from 5 to 7 percent silica. Some high-silica bauxites yield to washing with a recovery of, say, 60 percent and with at least proportionate elimination of undesired impurities like iron and titanium. If washing is inadvisable, direct leaching means higher freight and treatment costs per unit recovered. If the ore contains free silica, and washing is not successful, flotation with cationic reagents may lower the silica content acceptably.

Re-treatment of the red mud residues means treating a product in which the ratio between impurities and aluminum content has been increased. The residue from leaching the sintered mud will require more filter area per ton and tend to retain more moisture. Efficient recovery of alumina and maintenance of purity in the metal from the electrolyzing pots will involve considerable operating control. The lime-soda sintering process is being used at the Arkansas alumina plant, where silica is expected to be around 13 percent. It involves sintering with lime and soda to break up the aluminum silicates and make insoluble alumina more soluble, and leaching the sintered material somewhat as in the Bayer process. Whatever lime and soda from the first leach are left in the red mud lessens the amounts required in sintering and re-leaching. The Metals Conservation and Substitution Group of the National Academy of Sciences Advisory Committee reported to the War Production Board during the year that such plants would be desirable at each of the Bayer process plants, the equivalent of 1,000,000 tons of bauxite being available at the Illinois alone. For clays where no Bayer plant is available together with a re-leach plant, a modified Pedersen process is considered as offering the most promise, and the need of a pilot plant is expressed. The T.V.A. has been running an acid-treatment pilot plant for obtaining alumina from kaolin, and a report on that will no doubt be available soon. For alunite the group expressed a preference for an acid process.

No data are available on the Canadian plants, but one knows that they are being substantially enlarged with U. S. government financial assistance. The RFC contracted in May to buy 685,000 tons of metal in three years. Cia. Brasileira de Aluminio plans to build a plant near Sorocaba, Sao Paulo, to produce metal from the Lindolpho Dias deposit near by. Bauxite reserve is estimated at 5,000,000 tons. Production of aluminum in Germany in 1941 was estimated at around 300,000 short tons by one domestic source, and at the same figure for 1943. German-controlled capacity in Europe was figured to be 620,000 tons at the end of 1941. The Norwegian plants are reported as being greatly expanded by German engineers. Production of bauxite and metal in France increased during the year, it is reported, due to the excellent quality and extent of French deposits and the relatively short haul to Germany. Pechiney and Duralumin companies, among others, used increased capital resources to expand production. Italian metal production is reported as reduced by shortage of electric power. One new plant was completed during 1942. Excess alumina production of past years sent to Germany paid for German-made equipment used in expansions. The Yugoslavian plants at Shibenika and Lozavitz were reported as being repeatedly sabotaged. This and the longer haul to Germany probably resulted in a large decrease in bauxite exports. India found workable deposits in the Shevaroy Hills 200 miles southeast of Madras. It is estimated that 100,000 long tons per year can be mined, and sufficient electric power is available near by.

CHROMIUM—The Bureau of Mines has been working on an electrolytic method for recovering high-grade metal from domestic ores. The ores are roasted and leached to obtain chromium as sodium chromate. Electrical energy required to obtain the metal by this method is said to be less than half that required by the usual electro-deposition processes.

COPPER—The WPB estimated United States production in 1942 as being near 3,000,000 tons, of which scrap accounted for more than 600,000 tons. Anaconda reopened its secondary copper unit in New Jersey for treatment of scrap brass. The Bor property, in Yugoslavia, with its own refinery, was reported damaged before coming into German hands.

MAGNESIUM—Early in 1941 a production rate of about 26,000 tons per year was the goal for magnesium production, but in June, 1941, the mark was set at 200,000 tons, and was to be attained by the end of 1942 or early 1943. In February, 1942, sights were raised to a yearly rate of 360,000 tons to be attained in 1943. The new rate involved construction of six Pidgeon process plants under contracts between Defense Plant Corp. and Union Carbide & Carbon Co., American Metal Co., National Lead Co., Ford Motor Co., Permanente Corporation and New England Lime Co. The capacity of these six plants was

set at 87,500 tons of metal per annum. The last program also involved a possible maximum of 72,000 tons from new Dow Chemical Co. plants in Michigan, electrolyzing magnesium chloride from new brine wells. The new wells are said to yield brine containing almost 10 percent as against 3 percent magnesium chloride in the old wells. The U. S. production rate attained by the end of 1941 was over 20,000 tons, and 130,000 near the end of 1942. A shortage of labor has been reported at several plants.

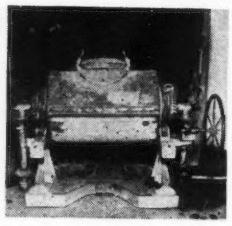
The second of the Dow sea-water plants in Texas started up late in June, 1942. The rated capacity is 36,000 tons and cost estimate $52,000,000. The process was described last year. The Dow plants in general evaporate magnesium chloride solution down to the monohydrate $MgCl_2 H_2O$, of which 15 percent is water. Elimination of the last molecule of water without forming the oxide or hydrate is very difficult and expensive.

The Mathieson Alkali Co. plant in Louisiana, first set at 18,000 tons and estimated to cost $22,500,000, was raised to 27,000 tons. The raw product is nearby dolomite, which is calcined and treated with waste calcium chloride liquor from other operations. On passing in waste gases from the calcining kilns, calcium carbonate is precipitated and filtered off. The magnesium chloride is evaporated and electrolyzed in a Trail-Mathieson type of cell, which yields rich chlorine gas, and no hydrochloric acid as does the Dow. Diamond Alkali Co. started up its Ohio plant late in October. It is rated at 18,000 tons and the cost estimate was $16,000,000. It uses the Dow type of cell. Like Mathieson, it treats calcined dolomite with waste calcium chloride liquor, but also treats calcined dolomite with hydrochloric acid made from the cell gases. The Union Potash Division of International Minerals & Chemicals Corp. built and started up a 12,000 ton plant in Texas during the year. It uses in part the waste liquor from potash operations in New Mexico carrying over 15 per cent magnesium chloride, which is evaporated and dried before shipment. The rest of the cell feed is obtained from Texas dolomite and hydrochloric acid in a manner analogous to that described in the foregoing.

Basic Magnesium Incorporated built a ten-unit plant, with D. P. C. funds, the units of which were prototypes of the 5,500-ton Magnesium Elektron, Ltd., plant in England. The original cost estimate of $60,000,000 has risen to over $100,000,000. Various difficulties were encountered on starting up late in August. Appar-

(*Continued on page* 151)

The Uncommon Metals



Magnesium production strides ahead; likewise metallurgy. New domestic sources of vanadium found. The N.E. steels

V. H. Gottschalk *Senior Physicist, Eastern Region, Bureau of Mines, College Park, Md.*

OUTSTANDING among the year's developments in the field of uncommon metals are: (1) The large increase in production capacity of metallic magnesium; (2) the discovery of two new domestic sources of vanadium; (3) several new processes for making domestic chromium deposits metallurgically available; (4) the unexpected shift of our most abundant uncommon metal, molybdenum, to W.P.B.'s Group I of metals the supply of which is inadequate for the demand; (5) a new source of tungsten; and (6) a definite easing in the fear of a manganese shortage.

MAGNESIUM—The large increase in magnesium production demanded for 1942 seems to have been realized, and a further doubling of capacity is the goal set for 1943. It has been stated that at least one-fifth of this prospective total will be produced by the ferrosilicon process reported in last year's review as having just reached the pilot-plant stage. Several descriptions of this new process have recently appeared in the technical press (see, for example, *Chemical and Metallurgical Engineering,* Vol. 49, page 87, April, 1942, and pages 134-137, September, 1942), from which it is obvious that this process does not use a high-frequency induction furnace, as stated in last year's review, but depends on external heating, by electricity where cheap electric power is available, or by gas, as in the several new American plants that began operations in 1942.

Progress in magnesium metallurgy is proceeding at an even more astounding pace than is indicated by this speedy conversion to practice of the Pidgeon ferrosilicon process. It is rumored that the few months' large-scale work with this process has already led to modifications in which external heat is replaced by internal heat, thus not only assuring greater thermal efficiency but also allowing a water-jacketed steel shell to be used instead of nichrome retorts. In addition, the condensing system has been much improved compared with the original Pidgeon set-up. There are further rumors of other fundamentally new methods for making magnesium metal, but these are still extremely vague.

VANADIUM—Anaconda Copper Mining Co. for some time has been producing a 90-percent vanadium oxide as a byproduct of its phosphoric acid plant. The phosphate rock treated contains approximately 0.3 percent V_2O_5 (0.16 percent V), of which 65 percent is recovered. U. S. Patent 2,193,092, issued to F. F. Frick and F. W. Woodman and assigned to the Anaconda Copper Mining Co., has been erroneously referred to as covering the process in which the vanadium content of a phosphoric acid solution is converted to the pentoxide by an oxidizing agent and the vanadium content then extracted by an organic solvent, such as ethyl ether. Actually this patent specifies treating the impure phosphovanadic acid precipitate resulting from oxidation with milk of lime and with soda ash in stepwise additions, acid being added to keep the hydrogen-ion concentration at the proper point so that the vanadium passes into solution, leaving a solid residue containing the phosphates. The vanadium is precipitated from the resultant solution as V_2O_5 by treatment with sulphuric acid.

Our Eastern phosphate deposits do not contain enough vanadium to be recovered economicallly, but new Western phosphate deposits are said to have been discovered, one with enough vanadium to be classed almost as an ore of vanadium. It is not known at this time whether these finds represent deposits of economic value or are interesting only as prospectors' samples.

When the separation of ilmenite from New York magnetites was put into commercial operation by pigment manufacturers about two years ago, it was found that the tailings contained 52 percent iron and 0.36 percent V_2O_5 and could be worked for iron and vanadium according to well-known procedures developed by the Russians. At that time it looked as if this new source might cover about two-thirds of the deficit between production and consumption, because plans were under

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way for recovering this vanadium from the blast-furnace slag obtained on smelting these magnetite-containing tailings. If these plans have materialized, there should have been a substantial output of vanadium from this source.

CHROMIUM—The problem of making domestic deposits of chromium ore metallurgically available is to raise the chromium : iron ratio from the prevalent 2 : 1 or less, to at least the minimum 3 : 1 specified by the ferrochromium industry. A solution of this problem, proposed this year by the U. S. Bureau of Mines, is as follows: The chromite ore concentrates are mixed with coke and treated in an especially designed rotary kiln. Reduced iron is then removed from the cooled product by gravity concentration or by magnetic methods; additional iron may be removed by leaching with sulphuric acid or sulphur dioxide, leaving a residue not only enriched in chromium, but with an enhanced chromium : iron ratio that may be as high as 30 : 1. The most economical procedure seems to be to produce a residue having a ratio of 5 parts chromium to 1 part iron, which will permit mixing 2 tons of residue with 1 ton of raw concentrates to give a mixture that may be smelted in the electric furnace to produce standard ferrochromium containing 70 percent chromium.

Another Bureau of Mines proposal for utilizing low-grade domestic chromite ores is leaching to produce a solution of trivalent chromium, which is then electrolyzed to deposit pure chromium metal. This process is still in the pilot-plant stage.

A third proposal for making metallic chromium from low-grade ores is based on hydrogen reduction of the chromium chloride obtained on chlorinating the ore. This process yields a product called "sponge chromium" because the non-pyrophoric metal is present as individual metallic crystals pseudomorphous with chromic chloride and about 1 micron in size, completely free from sintering or nodulization. Sponge chromium is 99.8 percent pure and contains 99.5 percent metallic chromium, the main impurity being chromium oxide. It is stated that "the cost of producing sponge chromium might be brought within the range of existing prices of 70 percent low-carbon ferrochrome; with especially 'sympathetic' bookkeeping relative to charges for chlorine it might be possible that the cost of the quality product could be brought within limits permitting competition with existing smelting of low-carbon metal" (quoted from Bureau of Mines Bulletin 436, "Sponge Chromium," by C. G. Maier, published in 1942.) It may be significant that the rights have been acquired by a chemical firm that uses much chlorine.

Among the new sources of chromite discovered this year, the Oregon beach sands deserve mention here because electrostatic separation (which has been shown to be efficient in extracting the chromite particles from these sands) may be the process chosen for recovering this chromium.

MOLYBDENUM—A most amazing achievement in the metal industry has been the development of the N.E. (National Emergency) steels as replacements for the standard S.A.E. steels. These N.E. steels are now being introduced into regular farbicating practice at a fairly satisfactory rate.

The significance of these N.E. steels for the industries engaged in producing uncommon metals is that the "ennobling" of ordinary steel to produce the low-alloy steels that constitute the S.A.E. steels (automotive or fabricating steels) may be accomplished with much smaller quantities of any given one of the uncommon metals (chiefly chromium and nickel) than was considered possible formerly, provided only that a suitable combination of two or more of the ennobling metals are present to "sweeten," as it were, the effect of the small amounts of molybdenum and silicon which are the main alloying elements. Molybdenum and silicon (and at times manganese, now that the supply of this element is no longer so dangerously critical) are introduced as ladle (or ingot) additions to the melted steel which already contains small amounts of chromium and nickel carried into the melt by the scrap.

By ennobling, as used as detailed in the foregoing, is meant an improvement in properties useful in the arts and industries. These are the mechanical properties of tensile strength, yield strength, ductility, machinability, weldability, and, above all, "hardenability" (depth of hardening). The new steels show that these desirable properties can be attained better by a combination of small amounts of the cheaper alloying elements than by larger amounts of any one (or two) of the ennobling elements alone. Why this should be so is a mystery.

A further embarrassment, from the viewpoint of the uncommon metals industry, is the still greater mystery involved in the fact established with certainty only this year that minute amounts of boron (a maximum of 0.0037 percent) also increase hardenability (and tensile strength) when added to alloy steels, including the N.E. series.

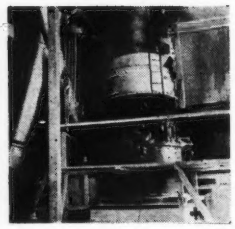
TUNGSTEN—The recently discovered antimony ore deposit in Idaho has been found to contain tungsten—so much, in fact, as to make possible a considerable increase in the domestic production of this superstrategic metal. This strange association of antimony and tungsten may be taken as another example of the well-known fact that every deposit of tungsten ore requires a separate investigation as to the best method for obtaining a commercial tungsten concentrate suitable for the standard metallurgical methods for making the metal or its alloys. Other interesting features developed during the year as regards tungsten cannot be discussed at this time.

MANGANESE—As everyone probably knows, the 5c. piece now contains no nickel, but is made of 35 percent silver, 56 percent copper, and 9 percent manganese. Based on the 1941 output of "nickels," this represents an annual saving of several hundred tons of nickel and about three-fourths as much copper, at the cost of a corresponding amount of the more expensive but less strategic silver. The formula used is one of a possible number selected from a small range of compositions in a restricted field of the ternary system, for which range the color, density, electrical resistivity, and mechanical behavior all meet the requirements of both the Mint and nickel-in-the-slot machines. Other substitutions of manganese for nickel have been reported in Germany and Russia, notably for the 18-8 type of corrosion-resisting alloys. An aëronautic group in this country published in 1942 a third set of extensive tests confirming the feasibility of such substitution in this class of alloys.

The Bureau of Mines studies on the treatment of various types of domestic manganese deposits were rounded out in 1942 by completion of the details for the matte-smelting of manganese silicate and other refractory ores. In this method, the manganese is made available by concentrating it in a matte incidental to smelting for copper or iron. This process has been considered even for the mixed carbonate nodules recovered from the South Dakota deposit.

A novel application of the old aluminothermic method for making metallic manganese from oxide concentrates is in use at an isolated manganese mine in Nova Scotia. There, with simple equipment consisting essentially of two barrels (drums) lined with a suitable refractory material and provided with tap holes, the oxide concentrate is roasted to yield Fe_3O_4 and Mn_3O_4; the iron oxide is separated magnetically, and the Mn_3O_4 is reduced with about one-third its weight of 10-mesh grain aluminum. The barrels are mounted on small trucks that can be pushed on tracks into the open, where the aluminothermic charge is blown, and, as the reaction is completed in two to four minutes, each barrel produces about 1 ton of manganese metal per day.

Industrial Minerals



Non-metallics hit war pace. Efforts are toward adequate supply. Mica, quartz crystal head strategic list

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IN THE FIRST WORLD WAR Turkish or Naxos emery provided a shipping problem, but artificial abrasives have taken its place. Use of South African corundum (or its equivalent) is increasing. There was also a notable revival in producing sandstone grinding wheels, which some manufacturers prefer for sharpening saws. To replace Danish flint pebbles, we are using more artificial and natural domestic grinding agents. Garnet is now a byproduct of tungsten milling in California, although the big deposits in Warren County, N. Y., still are the principal source. Sales of diatomite, commonly listed as an abrasive, topped all previous records.

ASBESTOS—The Canadian asbestos industry, working to capacity, continues the main source of spinning fibers and shorts, supplemented by imports from Africa. Production of low-iron asbestos increased in Arizona in 1942 but Rhodesian chrysotile is the principal fiber for electrical insulation. A deposit, between Canadian and Rhodesian in iron, awaits milling equipment in Venezuela. A very small quantity of low-iron asbestos is available in the serpentine found with the magnesitic dolomite in the Grenville district of Quebec. Chrysotile prospects are being opened in Peru and Turkey. Even in Africa reserves of long-fiber amosite needed for marine power-plant insulation are limited and short fiber is being used for high-pressure steam-pipe and boiler coverings.

CLAY—American potters bought more domestic clay in 1942 than ever before. A proposal to shift clay miners in Cornwall to the tin mines was halted, as stoppage of shipments to the United States would result in English clays losing even their few remaining markets in this country. Necessary adjustments to offset the lack of Klingenberg and other German clays are virtually completed. Most crucible and pencil makers have found suitable domestic substitutes although a new Brazilian clay has found some favor for pencil lead.

Demand for paper clays and rubber clays declined from the 1941 records, but fireclay sales reflected the brisk demand for refractories. Foundry requirements boosted shipments of bentonite, notably for use in synthetic molding sands for magnesium castings.

Structural clay products fared better than other building materials partly because brick walls and wooden roof trusses were not subject to priorities and so were specified for many industrial buildings. Total sales of heavy clay products in 1942 were probably 10 percent ahead of those of the preceding year but a sharp curtailment in the last few months bodes ill for 1943.

Canada gets its kaolin and other clays principally from the United States and the United Kingdom but the Canada China Clay Co. built a flotation plant in 1941, lost it by fire, and may rebuild in 1943. Bentonite from the Morden district, southern Manitoba, is being activated for bleaching mineral and animal oils.

DOLOMITE AND MAGNESIA—War time magnesium-metal plants using dolomite are scattered from Connecticut to California and from Washington to Texas. New processes for making magnesia from dolomite, although based on differential solubility after partial calcination, are more economical than was the old Pattinson process for technical carbonate, but in California a modification of the latter is proposed for making basic magnesium carbonate from magnesite. Since this sedimentary magnesite is fine-grained and dissolves readily after calcining, the operations are conducted at atmospheric pressure instead of 6 or 7 atmospheres. To calcine magnesite in Nevada, 14-hearth Herreshoff furnaces have been installed.

Domestic production of refractory magnesite from brines, sea water, natural magnesite, and dolomite is believed ample to meet the steel industry's expanded demands, despite the cutting off of imports. However, attention has been drawn to other deposits in this hemisphere. Perhaps the largest and best situated in regard to transportation is the Ceara deposit, in Brazil, already producing on a small scale. To replace Indian and Grecian magnesite in flooring and other special uses of caustic calcined, Cuban magnesite is being mined. The quality is excellent, deposits are small, and production costs high.

In Canada calcined brucitic limestones are used to make magnesium metal by the Pidgeon process. They are also utilized in a new plant employing the Canadian Bureau of Mines process to produce refractory magnesia and hydrated lime.

FERTILIZER MATERIALS—Sharp curtailment of phosphate-rock exports was largely offset by increased consumption, so production was held around the all-time records of 1941. Better recoveries and higher-grade products continue to occupy attention.

Domestic production of potash exceeded consumption in the United States for the first time in 1941 and there was a further increase in the 1942 output, most of which comes from New Mexico's bedded deposits and California and Utah brines. Improvements in refining, larger shipments of run-of-mine salts, and less labor trouble all contributed to the 1942 record. A new estimate of reserves, by G. R. Mansfield of the U. S. Geological Survey, indicates about 200 years' supply at the present production rate. All four large producers continued prospecting; likewise the Defense Plant Corporation. Demand is growing.

FLUORSPAR—Reserves in the Illinois-Kentucky field ordinarily are not developed far in advance of mining, but in 1942, 14 drills were in operation and the Bureau of Mines and Geological Survey were conducting explorations to offset a threatened reduction in output. Deposits in Colorado and New Mexico were equipped with new flotation mills, steps were taken to expand production in Mexico and Newfoundland, and old mines in Ontario were reconditioned.

GRAPHITE—The only graphite that is considered critical is crucible flake, representing in this war about 15 percent of our total consumption. A year ago a shipload of flake arrived from Madagascar, consumption was restricted under War Production Board Order M-61, American mines were reopened, and flowsheets were modified so as to scalp off the largest flake and to increase over-all recovery. Conquest of Madagascar, how-

ever, made available ample supplies of standard flake, and exploration of new coarse flake prospects in Portuguese East Africa, Canada, and other foreign places was dropped. In Renfrew County, Quebec, production of small flake graphite continued at one property.

Mexican amorphous graphite supplies half to two-thirds of the graphite consumed in the United States, but production in Sonora expanded more than enough, so some curtailment at the mines was necessary near the year end.

KYANITE — Deliveries of massive kyanite from India were restricted during most of 1942. Consumption was drastically controlled. This situation subsequently improved and no real shortage developed. Prospects for 1943 are much improved. Meanwhile, experiments are under way to substitute massive sillimanite, which seems to be abundant in Australia. Production of domestic kyanite concentrates continues to increase at the large plant of the Kyanite Products Co. in Virginia. The Defense Plant Corporation took over the old Celo Mines plant in North Carolina and began remodeling to increase its capacity.

MICA — Definition of "strategic" mica has been revised several times as manufacturers found that it was impossible to obtain the higher qualities of block. There is reason to believe that vegetable staining, and possibly some degree of mineral staining, are less detrimenta than previously supposed, and, although mechanical defects must be absent, even waviness can be tolerated to a fair degree. Owing to orders placed in anticipation of stoppage of Indian supplies through invasion by Japan and internal unrest, and also to curtailment of consumption for civilian uses, the mica splittings situation was relatively easy; also the supply of lower qualities of electrical block mica. Attention was directed to expanding production and improving the trimming and qualification of mica in Brazil, the second largest source of good mica, and in other countries.

To make the most of domestic resources the Colonial Mica Corp. was organized as an agent of Metals Reserve Co. District offices were set up in New England, in the South, and in the West. Domestic production, particularly of the better kinds of sheet mica, increased substantially. Through Colonial, the Government rents mining equipment, furnishes engineering service and technical advice, and buys the mica at prices up to 15 times what the miners could get for their product the previous year. At Asheville, N. C., domestic punch mica was being sorted and prepared so as to yield a maximum of No. 6 and larger sizes comparable to Indian trimming standards.

In Canada, new discoveries of muscovite mica were made in several districts. Colonial Mica has agreed to buy the product. Production of phlogopite mica was roughly the same as in 1941.

Although mica is listed under General Imports Order M-65, WPB policy has been to grant exemptions to private importers except from India, where all purchases are now made by a British-American joint buying mission, and Brazil, where the U. S. Purchasing Commission is the sole buyer, and Canada, where Colonial Mica Corp. is to function as stated. The agency in Brazil has undertaken a stimulation program similar in many respects to that of Colonial Mica in the United States. Somewhat similar programs are planned for Peru, Guatemala, and Colombia. In Mexico it is proposed to finance a local exploration company in the Oaxaca district, where production of phlogopite mica splittings is comparable to that in Canada.

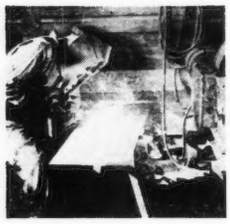
Scrap mica is not strategically important but American grinding mills were busy.

QUARTZ CRYSTAL—Purchases of quartz crystal in Brazil increased enormously in 1941 and shipments to the United States were heavy early in 1942, but when it was found that much of the quartz thus acquired for stockpile failed to meet the rigid inspection adopted by the National Bureau of Standards, the Metals Reserve Co. withdrew from the market. American engineers were sent to visit the various producing areas, a new price schedule was negotiated, and an inspection laboratory was set up in Rio Janeiro. In December the production of quartz was improving in quality and quantity. Even in Brazil only a fraction of the crystal mined is of radio quality. With this knowledge quartz crystal sources in other parts of the world are being reinvestigated. Substantial production is anticipated in 1943 from domestic deposits, notably in Arkansas, and from various other countries.

TALC—The principal war use of talc is in paints for tanks, bombs, shells, and ships, but the real procurement headache was the supply of low-iron lime-free talc for steatite products for radio equipment. To conserve supplies, WPB Order M-230 prohibited the use of steatite talc for cosmetics. Detailed studies of districts in California and Nevada were made. A flotation plant is being built to produce steatite grade concentrates. Tests are being made on New York talc. In Canada, tests have been made to reduce the CaO content of Madoc, Ont., talc and a new plant was being built to make steatite electrical insulators. African wonder stone, a talc-like mineral resembling agalmatolite or pyrophyllite, is imported for use in airplane instruments. Both steatite and lava-grade talc are being bought in British India.

MISCELLANEOUS—Domestic production of **barite** increased in 1942 more than general industrial activity, owing to large orders and reduced imports. **Feldspar** producers had a good year. In the container glass trade they felt the competition of nepheline syenite and aplite, but this was offset by much larger sales of pottery spar. Geological Survey studies of pegmatites have increased known supplies of **beryl** and **lithium minerals.** Byproduct production of lithium salts at Searles Lake, Calif., has been increased. Spanish mines have been reopened, new supplies of amblygonite and spodumene are dribbling into the United States from Brazil and Argentina, and substantial shipments are scheduled to start from Australia. **Strontium** is another prominent element, used for tracer bullets and red flares. Domestic deposits promise to be our main source in 1943. Reserves in Texas and California are enormous, but hand-sorting has failed to yield a product low enough in calcium and barium. **Sulphur** production and shipments during the latter part of the year failed to continue at the record levels of recent years, attributed to transportation difficulties and satisfactory condition of consumers' stocks. **Borax** found a new use—as a paint addition; other minor uses of borax that grew in 1942 were in fertilizers and as an addition to steel, which it improves in hardenability, ductility, and toughness. **Mineral** pigments were in active demand. The scarcity of chrome for yellow pigments helped sales of ochers, and several minerals found their way into the new phosphorescent coatings and fluorescent powders for use during blackouts. **Vermiculite** sales showed a large increase in 1942, principally as a result of the increased use of material smaller than that used for house fill. A recent count showed 31 processing plants making house-fill pellets. Relatively large quantities were used in poured-concrete roof decks and insulating concrete for roofs and floors of industrial buildings and for deck covering and firewalls of tankers exposed to bombing attack. Vermiculite blocks or bricks are used in oil-refineries for refractory as well as insulating service.

MINE EQUIPMENT



Manufacturers largely abandon development programs and devote all facilities to war. Protective maintenance emphasized

Robert H. Ramsey *Assistant Editor*

MORE NEW EQUIPMENT was produced in 1942 by mining machinery manufacturers than ever before in the history of the industry, but little of it bore any relation to mining or milling. Nearly all plants are now converted, at least in part, to war work, and the list of recipients of the Army-Navy "E" for excellence in the production of war materials now reads like a roll-call of industry. Nevertheless, developments in purely mining machinery have been made and will continue to be made, because obviously raw materials production must be kept at a maximum or all industry will slow down.

ROCK DRILLS—Advances in rock drill design in 1942 were aimed generally at securing longer operating life through strengthening parts or reducing vibration. Gardner-Denver Co., Quincy, Ill., introduced its new model CF79, a 3-in. companion to the 3½-in. CF89H already announced. Feature of the drill is a smooth-running continuous-feed motor entirely under control of the operator.

Ingersoll-Rand, New York, N. Y., announced the new X71WD, a drifter drill suitable for deep-hole drilling, said to have a heavier piston and a longer stroke than any drill now in use.

Cleveland Rock Drill Co., Cleveland, Ohio, offers a revised version of its Jumbo drill rig for mine use. Originally planned for two feed arms, the new rig can accommodate three or four booms and operations can proceed at three different levels simultaneously.

Sullivan Machinery Co., Michigan City, Ind., has announced a wagon-mounted drill of medium weight for mine and quarry use which features strong and rigid mounting and ease of adjustment to working position requirements.

Anton Smit & Co., New York, N. Y., brought out the only new development in the field of diamond drilling in their Nicolite diamond core bits. Suitable for use in abrasive formations, the new bits are made of a special hard-metal alloy, more resistant than metals formerly used.

AIR COMPRESSORS—Economy of operation and lower maintenance costs are said to characterize the new line of portable air compressors announced by Chicago Pneumatic Tool Co., New York, N. Y. The new CP gradual speed regulator is used with these units. Capacities range from 100 to 500 c.f.m.

Sullivan Machinery Co., Michigan City, Ind., announces a new heavy-duty, single-stage, double-acting air compressor which is said to possess high capacity per foot of floor area. Of vertical construction, the machine is easily installed and presents certain operating advantages. It is made in sizes up to 822 c.f.m.

EXPLOSIVES—A contribution to ease in placing dynamite cartridges in bore holes was made in 1942 by E. I. du Pont de Nemours & Co., Inc., Atlas Powder Co., and Hercules Powder Co., all of Wilmington, Del. Each company now provides a cartridge which expands in the hole upon being tamped and is thus wedged firmly into place. The method used in each case is different, but the objectives of easier, more efficient blasting are the same.

MECHANICAL LOADING—To supply a dependable electric loader for large tunnel jobs, Eimco Corp., Salt Lake City, Utah, designed the Model 40 Electric Tunneloader, which can muck 4 tons per minute into a large combination hopper-conveyor.

Automatic or remote-controlled scraper haulers were offered by Sullivan Machinery Co., Michigan City, Ind. Use of this equipment enables the operator to observe digging progress from the most advantageous point, rather than from the fixed, perhaps awkward, location of the hoist drums.

HAULAGE—Atlas Car & Mfg. Co., Cleveland, Ohio, built some storage battery mine locomotives for use in Australia which contained as new features an interlocking brake and power system such that power is disconnected as soon as the brakes are applied. The controller handle must then be returned to neutral before power can be reapplied. The new locomotives weigh 5 tons and use two motors which total 19 hp.

Mancha Division of Goodman Mfg. Co., Chicago, Ill., introduced a metal mining trolley locomotive for light service. Total weight is 3 tons. The two motors supply 33 hp., and drawbar pull at 6 m.p.h. is 2,100 lb.

Bethlehem Steel Co., Bethlehem, Pa., has developed a steel mine tie for use in metal mines which is said to facilitate both track laying and maintenance. Also offered are: track work built to specifications; a floating drawbar adaptable to all mine cars using a link-and-pin coupling; and a 10-ton, double-truck mine car designed particularly for use with mechanical loaders.

CRUSHING AND GRINDING—Allis-Chalmers Mfg. Co., Milwaukee, Wis., designed a new jaw crusher said to provide economy of operation and increased capacity. It is built with rolled steel and welded side frames to obtain great strength with less weight. Receiving opening is 48x42 in.

Dixie hammermills of the non-clog type were used successfully by Coronet Phosphate Co. in Florida to reduce clay balls formed during their mining process, and this equipment was also installed to handle similarly difficult conditions in a number of other plants. Featuring a moving breaker plate, the mill is manufactured by Dixie Machinery Co., St. Louis, Mo.

CLASSIFIERS—During the year, Western Machinery Co., San Francisco, Calif., redesigned the Wemco screw classifier to include a motor-driven lifting device which will raise the screw automatically if desired, and a wash box and multiple flight arrangement for use with heavy ores or concentrates.

Deister Concentrator Co., Ft. Wayne, Ind., announced the Model SO constriction plate classifier, a hydraulic unit which represents an improvement over earlier models in the increased cell depth, redesigned spigot and orifice bushings, and use of porcelain orifice bushings to secure greater wearing capacity.

Hardinge Co., York, Pa., announced that its new Hydro-classifier, which incorporates a screw dewaterer, was placed in operation in 1942. A close sizing and a nearly dry discharge are said to be obtained. Hardinge Co. also informs us that its conical ball mill, using special grinding medium, has been found particularly suitable for grinding magnesium metal.

CONVEYING—Goodyear Tire & Rubber Co., Akron, Ohio, introduced a conveyor belt which is reinforced with steel wire instead of the cord or fabric carcass ordinarily used. With the thickness of a normal 6-ply belt, the

new belt has a strength equivalent to 14 such plies. This steel-reinforced belt is now being used by Oliver Iron Mining Co. to move iron ore out of a pit 240 ft. deep over a slope distance of 1,100 ft.

MAGNETIC SEPARATION—Abrupt increase in demand for base metals has resulted in a number of new applications of magnetic separation, and it is in this field that the greatest development and activity has been shown this past year. Dings Magnetic Separator Co., Milwaukee, Wis., reports that its Crockett Type K separator now possesses improved feed launders and middlings and tailings tanks, and that increased use of sprays in the pick-up section resulted in lower tailing losses. The design has also been slightly altered better to fit the machine for use in the ferrosilicon sink-and-float process. Dings also turned out the largest magnetic pulley ever built; its diameter is 48 in. and its weight 10 tons. The Dings Magnetic Detector was introduced in 1942 as a protection for crushers against tramp iron, even against only slightly magnetic manganese tool steel.

Magnetic Engineering & Mfg. Co., Clifton, N J., announced the Memco Type CB magnetic separator, an improved machine of the cross-belt type. All windings of each pole are above the belt, each cross belt has its own complete circuit with controlling rheostat, and each magnetic pole has been designed with multiple edges to secure increased capacity. The company also brought out a wet type separator which utilizes a new method of roughing and cleaning concentrates.

Three new items were introduced by Stearns Magnetic Mfg. Co., Milwaukee, Wis. These were: a magnetic log washer for treating fine abrasive materials in the wet state; a laboratory size magnetic separator which employs a small steel inductively magnetized take-off ring instead of a belt; and an improved Type R Wetherill cross belt separator, featuring stronger and cleaner design and improved control devices.

ELECTROSTATIC SEPARATION—After many years of comparative obscurity, electrostatic separation has been adapted in the past year to a number of separation problems which, unfortunately, cannot even be hinted at for the present at least.

Ritter Products Corp., Rochester, N. Y., has designed new equipment for electrostatic separation of a number of mineral products, and tonnage treated in these plants has increased greatly in recent months. Cost is said to range between $0.15 and $0.28 per ton, and about 2.5 kw. are required per ton.

Separations Engineering Corp., New York, N. Y., introduced a low cost electrostatic separator which is said to have a capacity per unit of 2.5 tons per hour on certain separations. The process depends on difference in conductivity between ore mineral and gangue.

FLOTATION—Most manufacturers of flotation equipment confined themselves in 1942 to installation of current models, and have had no time for development work. American Cyanamid Co., New York, N. Y., has installed a great many straight-line Fagergren flotation cells in strategic mineral plants, but development work has been largely confined to heavy-media separation processes. Denver Equipment Co., Denver, Colo., reports certain modifications of its flotation cell to suit new applications, and announces that its placer unit has been adapted for recovery of the heavy strategic minerals. An interesting application of flotation equipment to other fields is that of the use of the rotor of the flotation machine made by Pan-American Engineering Co., Berkeley, Calif., as an aërator in several sewage disposal plants built by the Dorr Co. recently at Army camps. Southwestern Engineering Co., Los Angeles, Calif., reports that it is manufacturing heat-transfer equipment for synthetic rubber plants as well as its regular equipment for ore-dressing purposes. The Galigher Co., Salt Lake City, Utah, announces expended pilot-plant facilities at its laboratory to care for increased strategic mineral work.

TABLING—Deister Machine Co., Ft. Wayne, Ind., has applied a number of improvements to its Plat-O concentrating table, with the result that recoveries of 89 to 90 percent on certain chrome ores are now obtained where 80 to 85 percent was formerly considered good.

Deister Concentrator Co., Ft. Wayne, Ind., supplied in 1942 No. 6 Diagonal-Deck concentrating tables for a new chrome plant in Montana and for our new tin smelter in the South, as well as for other strategic mineral operations. As new equipment the company announced a laboratory-size (2x4-ft. deck) concentrating table which incorporates all the new features in use on the full-size machines.

THICKENERS—T. Shriver & Co., Harrison, N. J., have announced a continuous, plate-type thickener for use in handling slurries containing solids which settle too slowly to be handled in the ordinary thickener. A new Shriver diaphragm pump for thick or corrosive pulps was also announced.

Western Machinery Co., San Francisco, Calif., developed a new traction type of thickener for installation in tanks over 150 ft. in diameter, and the company also developed a new automatic rake-lifting device which guards against overload damage. The Wemco diaphragm pump was also improved by addition of a new type of eccentric.

The Dorr Co., New York, N. Y., reports construction in Nevada of several thickeners 250 ft. in diameter and using center-pier, center-drive construction. These are the largest thickeners ever used for countercurrent decantation.

MINE SAFETY—Plastic materials entered the mine safety field when Mine Safety Appliances Co., Pittsburgh, Pa., announced the conversion of its Dustfoe respirator from aluminum to all-plastic construction. The material is transparent and it is therefore possible to inspect the filter without removal from the respirator. A transparent plastic eyeshield has also been added to the M. S. A. Skullgard.

E. D. Bullard Co., San Francisco, Calif., brought out during 1942 a wide variety of first-aid kits for industrial use, and also introduced a rubber "lung," a device for applying artificial respiration.

ELECTRICAL EQUIPMENT—The amplidyne generator, developed by General Electric Co., Schenectady, N. Y., was applied to electric shovel generator control, replacing three-field variable voltage equipment. Smoother performance, increased production, and lower maintenance costs resulted. (See *E.&M.J.*, Nov. 1942, p. 53.)

MISCELLANEOUS—Syntron Co., Homer City, Pa., offers an electromagnetic vibrator for aiding in emptying ore bins. The device is bolted permanently to the side of the bin and a free-flowing discharge is insured.

A new line of ultra-violet lamps was introduced by Ultra-Violet Products, Inc., Los Angeles, Calif. The new lamps are said to be lighter in weight than former models and to be more efficient in ultra-violet radiation.

To supply a washing mechanism superior to ordinary trommel screens or log washers, Smith Engineering Works, Milwaukee, Wis., developed the Telsmith Super Scrubber. This rotary washer somewhat resembles a concrete mixer in its agitating and discharge mechanism.

In the field of dust collection, Northern Blower Co., Cleveland, Ohio, has made a number of new installations of dust collection equipment for zinc and lead smelters, and its new bag type dust arrester is proving very valuable at a number of new Waelz installations throughout the country. Rapid automatic cleaning is a feature.

Summary of the MARKETS

WITH THE LIGHT METALS moving into a prominent position because of greatly expanded output, the non-ferrous metal industry was interested in an unexpected reduction in the price of magnesium. On Jan. 8, OPA announced that the leading producer, at the request of the price authorities, had lowered the price 2c. a pound, which established the quotation for magnesium ingot, carload lots, at 20½c. The downward revision in the price was made retroactive to Jan. 1, 1943. The price situation in aluminum was unchanged, ingot holding at 15c. a pound. Bismuth was placed under full allocation by WPB, effective Feb. 1. The premium price plan on over-quota production of copper, lead, and zinc was extended during the last month to July 31, 1945.

Solely to aid miners of zinc and lead who find it impossible to maintain operations under the original quota plan, extra premium levels have been established for those metals. The premium plan for copper has not been dis-

UNITED STATES MARKET

1943 Jan.	Electrolytic Copper: Domestic (a) Refinery	Electrolytic Copper: Export (b) Refinery	Straits Tin: New York	Lead: New York	Lead: St. Louis	Zinc: St. Louis
1	Holiday	Holiday	Holiday	Holiday	Holiday	Holiday
2	11.775	11.700	52.000	6.50	6.35	8.25
4	11.775	11.700	52.000	6.50	6.35	8.25
5	11.775	11.700	52.000	6.50	6.35	8.25
6	11.775	11.700	52.000	6.50	6.35	8.25
7	11.775	11.700	52.000	6.50	6.35	8.25
8	11.775	11.700	52.000	6.50	6.35	8.25
9	11.775	11.700	52.000	6.50	6.35	8.25
11	11.775	11.700	52.000	6.50	6.35	8.25
12	11.775	11.700	52.000	6.50	6.35	8.25
13	11.775	11.700	52.000	6.50	6.35	8.25
14	11.775	11.700	52.000	6.50	6.35	8.25
15	11.775	11.700	52.000	6.50	6.35	8.25
16	11.775	11.700	52.000	6.50	6.35	8.25
18	11.775	11.700	52.000	6.50	6.35	8.25
19	11.775	11.700	52.000	6.50	6.35	8.25
20	11.775	11.700	52.000	6.50	6.35	8.25
21	11.775	11.700	52.000	6.50	6.35	8.25
22	11.775	11.700	52.000	6.50	6.35	8.25
23	11.775	11.700	52.000	6.50	6.35	8.25
25	11.775	11.700	52.000	6.50	6.35	8.25
26	11.775	11.700	52.000	6.50	6.35	8.25
27	11.775	11.700	52.000	6.50	6.35	8.25
28	11.775	11.700	52.000	6.50	6.35	8.25
29	11.775	11.700	52.000	6.50	6.35	8.25
30	11.775	11.700	52.000	6.50	6.35	8.25
	AVERAGES FOR MONTH					
Jan.	11.775	11.700	52.000	6.50	6.35	8.25
	AVERAGES FOR WEEK					
6	11.775	11.700	52.000	6.50	6.35	8.25
13	11.775	11.700	52.000	6.50	6.35	8.25
20	11.775	11.700	52.000	6.50	6.35	8.25
27	11.775	11.700	52.000	6.50	6.35	8.25
	CALENDAR WEEK AVERAGES					
2	11.775	11.700	52.000	6.50	6.35	8.25
9	11.775	11.700	52.000	6.50	6.35	8.25
16	11.775	11.700	52.000	6.50	6.35	8.25
23	11.775	11.700	52.000	6.50	6.35	8.25
30	11.775	11.700	52.000	6.50	6.35	8.25

SILVER, GOLD AND STERLING EXCHANGE

1943 Jan.	Sterling Exchange: "Checks" (Nominal)	Sterling Exchange: "90-day demand"	Silver (c): New York	Silver: London	Gold: London	Gold (d) United States
1	Holiday	Holiday	Holiday	Holiday	Holiday	Holiday
2	401.000	(f)	(e)	(e)	(e)	$35.00
4	401.000	(f)	44.750	23.500	168s	35.00
5	401.000	(f)	44.750	23.500	168s	35.00
6	401.000	(f)	44.750	23.500	168s	35.00
7	401.000	(f)	44.750	23.500	168s	35.00
8	401.000	(f)	44.750	23.500	168s	35.00
9	401.000	(f)	(e)	(e)	(e)	35.00
11	401.000	(f)	44.750	23.500	168s	35.00
12	401.000	(f)	44.750	23.500	168s	35.00
13	401.000	(f)	44.750	23.500	168s	35.00
14	401.000	(f)	44.750	23.500	168s	35.00
15	401.000	(f)	44.750	23.500	168s	35.00
16	401.000	(f)	(e)	(e)	(e)	35.00
18	401.000	(f)	44.750	23.500	168s	35.00
19	401.000	(f)	44.750	23.500	168s	35.00
20	401.000	(f)	44.750	23.500	168s	35.00
21	401.000	(f)	44.750	23.500	168s	35.00
22	401.000	(f)	44.750	23.500	168s	35.00
23	401.000	(f)	(e)	(e)	(e)	35.00
25	401.000	(f)	44.750	23.500	168s	35.00
26	401.000	(f)	44.750	23.500	168s	35.00
27	401.000	(f)	44.750	23.500	168s	35.00
28	401.000	(f)	44.750	23.500	168s	35.00
29	401.000	(f)	44.750	23.500	168s	35.00
30	401.000	(f)	(e)	(e)	(e)	35.00
	AVERAGE FOR MONTH					
Jan.	401.000	.....	44.750	23.500	.....	35.00
	AVERAGES FOR WEEK					
Jan.						
6	401.000	.....	44.750	.....	.....	.....
13	401.000	.....	44.750	.....	.....	.....
20	401.000	.....	44.750	.....	.....	.....
27	401.000	.....	44.750	.....	.....	.....

Calendar week averages, New York Silver; 2nd, 44.750; 9th, 44.750; 16th, 44.750; 23rd, 44.750; 30th, 44.750.
(e) Not quoted (Saturday). (f) No quotations.

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.225c. per pound, the average differential for freight and delivery charges.

(b) Export prices are net at refineries on the Atlantic seaboard and include sales of domestic copper in the foreign market. Owing to the World War and the disruption of normal trade relations, our export copper quotations, since September, 1939, have been based largely on f.a.s. transactions, ex United States ports. We deduct .05c. from the f.a.s. basis (lighterage, etc.) to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingot bars; cathodes are sold at a discount of 0.125c.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East and Middle West in nearly all instances command a premium of 1c per pound over the current market for Prime Western but not less than 1c over the *Engineering and Mining Journal's* average quotation for Prime Western for the previous month.

Quotations for lead reflect prices obtained for commond lead, and do not include grades on which a premium is asked.

(c) Silver other than newly-mined domestic, by Handy & Harman. Under Treasury order of July 6, 1939, the price on domestic newly-mined silver mined subsequent to July 1, 1939, was fixed at 71.11c per troy ounce. Handy & Harman's quotation on newly-mined domestic silver, 999 fine was 70⅝c. throughout January.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold in domestic and imported ore or concentrate is at 99.75 per cent of the price quoted by the Treasury, which at present is equal to $34.9125.

turbed under the revised schedule.

Copper deliveries to domestic consumers continued at a record rate to supply the war machine. Civilian needs are being cut sharply. It was stated officially that the communications industry in 1943 will not take more than 12,000 tons of copper for maintenance and repair, and an equal tonnage will be returned by that group during the year as scrap. Last year this industry took about 35,000 tons. Domestic copper sold throughout January on the basis of 12c., Connecticut Valley, and foreign copper was brought into the country on the basis of 11.75c., f.a.s. United States ports.

OPA's lead order has been amended to simplify the measure and correct inequalities in reference to some basing points. The changes brought the order in line with regular trade practices. Total supply of lead for 1943 will cover present known needs and leave a margin for stockpile, according to the head of the Tin-Lead Branch of WPB. However, the authorities are no longer counting on imports of lead from Canada and Australia.

Lend-Lease shipments of zinc during 1942 amounted to 12 percent of this country's new supply—production plus imports—according to a report to Congress. Fair tonnages of the ordinary grades of zinc are being held in reserve for conversion into High Grade.

Though industry representatives view the antimony supply situation as satisfactory, and hope for some relaxation in the controls on consumption, WPB is moving slowly in the matter of easing the conservation order. Washington contends that a larger stockpile is desirable under present conditions.

New supply of manganese ore in 1942 was substantial, and fully 88 percent of the tonnage was of foreign origin, based on a report made public in Washington.

Quicksilver prices have been stable, despite the heavy demands of consumers.

E & M J PRICE INDEX

Weighted index of non-ferrous metal prices. The average for the years 1922-1923-1924 equals 100.

1929	110.33	1936	73.45
1930	82.87	1937	90.86
1931	60.20	1938	73.67
1932	48.26	1939	77.71
1933	59.79	1940	79.22
1934	69.59	1941	83.49
1935	74.66	1942	86.80

	1941	1942	1943
January	82.48	85.39	88.74
February	82.76	85.90	....
March	83.27	85.90	....
April	83.48	85.90	....
May	83.51	85.90	....
June	83.48	85.90	....
July	83.60	85.90	....
August	83.39	85.90	....
September	83.34	88.74	....
October	83.84	88.74	....
November	84.32	88.74	....
December	84.42	88.74	....

CURRENT PRICES — MISCELLANEOUS METALS, ORES, AND NON-METALLIC MINERALS

Quotations cover wholesale lots, prompt shipment, f.o.b. New York, unless otherwise stated

(February 1, 1943)

MISCELLANEOUS METALS

Aluminum, ingot, 99 plus per cent, lb	15c.
Antimony, domestic, spot, lb. 5 ton or more	16.049c.
Bismuth, ton lots, lb	$1.25
Cadmium, commercial sticks, lb	90c.
Calcium, lb., ton lots 97 @ 98 per cent	$1.25
Chromium, 97 per cent grade, lb	89c.
Cobalt, 97 to 99 per cent, per lb	$1.50
Nickel, electrolytic cathodes, lb	35c.
Magnesium, 99.8 per cent, carloads, lb	20½c.
Palladium, troy oz	$24.00
Platinum, (Official quotation) troy oz	$36.00
Quicksilver, flask of 76 lb., 100 flasks or more	$196.00@$198.00
Radium, mg. radium content	$25.00@$30.00
Selenium, 99.5 per cent, lb	$1.75
Silicon, minimum 97 per cent, spot, carloads lb	14.75c.
Tellurium, lb	$1.75
Thallium, 100 lb. or more, lb	$10.00
Titanium, 96 to 98 per cent, lb	$5.00

METALLIC ORES

Beryllium Ore, 10 to 12% BeO. f.o.b. mines, ton	(b) $60.00@$80.00
Chrome Ore, per long ton, f.o.b. cars Atl. ports, dry, 48% Cr_2O_3, 2.8 to 1 ratio	$41.00
48% Cr_2O_3, 3 to 1 ratio	$43.50
Iron Ore, Lake Superior, Lower Lake ports, long ton:	
Old Range bessemer	$4.75
Mesabi bessemer	$4.60
Old Range non-bessemer	$4.60
Mesabi, non-bessemer	$4.45
Lead (Galena) 80 per cent, Joplin, Mo., ton	$76.54
Manganese (dutiable) f.o.b. cars Atl. ports, long ton unit Mn:	
50 per cent	79.8c.
48 per cent	78.8c.
46 per cent	76.8c.
Manganese Ore, domestic, 48%, f.o.b. mines, l.t. unit	96c.@$1.00
Molybdenum Ore, 90%, per lb. of MoS_2, f.o.b. mines	45c.
Tungsten Ore, per unit of WO_3:	
Chinese, 65 per cent, duty paid	(b) $24.00
Domestic, 65 per cent and upward	(a) $26.00
Vanadium Ore, per lb. of contained V_2O_5 f.o.b. mines	27.50c
Zinc Ore, Prime, 60 per cent concentrate, Joplin, Mo; per ton	$55.28

(a) Prices at mines, small lots, usually several dollars less. (b) Nominal

METALLIC COMPOUNDS

Arsenious Oxide (arsenic) lb	4c.
Cobalt Oxide, 70 @ 71 per cent, lb	$1.84
Copper Sulphate, 100 lb	$5.15

ALLOYS

Beryllium Copper, 2.5 to 3 percent Be, per lb. of contained Be	$15.00
Ferrochrome, 65 @ 70 percent per pound of Cr contained	13c.
Ferromanganese, 78 @ 82 per cent, gross ton	$135.00
Ferromolybdenum 55 @ 65 per cent Mo. lb. of Mo. contained	95c.
Ferrosilicon, 50 per cent, gross ton	$71.50
Ferrotungsten, 75 @ 80 per cent, lb. of W contained	$1.90
Ferrovanadium, per lb. of V, delivered	$2.70@$2.90
Silicomanganese, 1½ per cent C, gross ton	$135.00

NON-METALLIC MINERALS

Asbestos, f.o.b. Canadian (Quebec) mines (U. S. funds), ton:	
Crude No. 1	$650@$750
Crude No. 2	$165@$385
Spinning fibers	$124@$233
Paper stock	$44@$49.50
Shorts	$14.50@$26.50
Vermont, f.o.b. Hyde Park:	
Shingle stock	$62.50@$65.00
Paper stock	$44.00@$53.00
Shorts	$14.50@$28.50
Floats	$19.50
Barytes, long ton:	
Georgia, crude	$9.00
Missouri, 93 per cent $BaSO_4$, less than 1 per cent iron	$6.75@$7.25
Bauxite, long ton:	
Domestic, crude, 50 @ 52 per cent (not dried)	$5.00
Domestic, chemical, 55 @ 58 per cent	$7.50@$8.50
Domestic, abrasive, 80 @ 84 per cent	$16.00
China Clay, f.o.b. mines, ton:	
South Carolina and Georgia, No. 1, bulk	$6.75@$8.00
Delaware, No. 1	$15.00
Feldspar, bulk, ton:	
Potash feldspar, 200 mesh	$17.00
Glass-spar, white, 20 mesh	$11.75
Fluorspar, f.o.b. mines, bulk, Kentucky and Illinois 85–5 per cent, all rail movement, ton	$28.00
Ground, 95 @ 98 per cent, bulk, ton	$34.00
Acid, 98 and 1 per cent, bulk, ton	$35.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00@$14.00
Magnesite, per ton dead-burned, f.o.b. Washington	$22.00
Mica, per lb., North Carolina, No. 1 and 2 quality:	
1½ x 2 in	90c. @$1.20
2 x 2 in	$1.50@$2.00
3 x 3 in	$2.00@$2.75
3 x 4 in	$2.50@$3.25
3 x 5 in	$3.00@$4.00
White, ground, ton	$60.00@$80.00
Ocher, Georgia, ton	$19.00@$22.00
Pyrites, Spanish, per long ton unit of S, c.i.f. Atlantic ports	12c., nom.
Silica, in bags, 325 mesh, ton	$20.00@$40.00
Sulphur, Texas, mines, long ton	$16.00
Talc, f.o.b. works, ton:	
New York, double air-floated, 325 mesh	$12.00@$15.00
Vermont, extra white, 200 mesh	$9.50@$10.50
Tripoli Missouri, ton:	
40 mesh, cream colored	$14.50
200 mesh, cream colored	$26.00

IRON AND STEEL

Pig Iron, Valley furnaces, gross ton: Basic	$23.50
Steel, base prices, Pittsburgh Billets, gross ton	$34.00
Structural shapes, 100 lb	$2.10

Personal Items

Charles J. Johnston, of the Goodnews Bay Mining Co., has been re-elected president of the Alaska Miners' Association.

Harvey T. Mudd has been appointed chief of the fluorspar section, Office of Operations, War Production Board, Washington, D. C.

Arvid Thunaes has been loaned by the Consolidated M. & S. Co. to the Board of Economic Warfare and has already left for South America on a special engineering undertaking.

C. D. M. Taylor, formerly with Ymir Yankee Girl Gold Mines, Ltd., has been appointed chief engineer at the Kootenay Florence Project of Wartime Metals Corporation.

A. H. Honsberger, formerly manager of the Gold Frontier mine at Red Lake, Ont., is in charge of development work for Reco Mountain Base Metals, Ltd., at the Noble Five mine at Sandon.

John G. Broughton, instructor in structural and engineering geology at Syracuse University, has resigned to become Assistant State Geologist of New York State.

Fred M. Kalenborn, formerly geologist for the Golden Center Mining Co., Grass Valley, Calif., has been appointed mine superintendent at the Iron Dyke mine, Homestead, Ore.

Edward Thornton, formerly vice-president and general manager of Summitville Consolidated Mines, Inc., Summitville, Colo., is now general manager of the Krome Corp., Marshfield, Oregon.

Dr. Russell S. Poor, head of the natural sciences division at Birmingham Southern College, has been elected chairman of the Southeastern Section of the A.I.M.E.

John Palecek, formerly superintendent at the property of West Coast Mines, Inc., Winnemucca, Nev., has been appointed superintendent of Tungstore mine, at Posey, Tulare County, Calif.

G. A. Joslin has been appointed consultant to the Metals Reserve Co. of Southern California. He plans to give a part of his time to this work but will continue to carry on private consulting practice in mining engineering.

Douglas C. McKay, engineer formerly active in Nevada and later at Baguio, has informed Nevada friends of his escape from Japanese captors in the Philippines and that he is now with the United States armed forces in the southwestern Pacific.

Fred W. Schonfeld, a graduate of University of Minnesota in physical metallurgy, has been appointed instructor in that branch at the State College of Washington. He will succeed **Dr. Herluf P. Nielsen,** who becomes metallurgist for Kinney Aluminum Co. at Los Angeles.

Howard I. Young, of St. Louis, president and general manager of the American Zinc, Lead & Smelting Co., has been appointed director of a new Mineral Resources Coordinating Division in the War Production Board and chairman of two committees, the Minerals and Metals Advisory Committee, and the

HOWARD I. YOUNG

Mineral Resources Operating Committee. The new WPB division will report directly to **Ferdinand Eberstadt,** Program Vice Chairman.

Mr. Young has spent most of his career in the mining industry. Born in **Jasper County, Mo., March 20, 1889,** he attended public school at Stott's City and the business college at Springfield. He entered the zinc mining industry in 1906 and became associated with the American Zinc, Lead & Smelting Co. two years later. In 1914 he was placed in charge of the company's mining operations in Missouri and in 1919 he became general manager of all mining operations. He was made vice president in charge of mining and smelting operations in 1928 and since 1930 he has been president and general manager of the company. He is president of the American Mining Congress and the American Zinc Institute and a director of several companies, including the Baltimore & Ohio Railroad and the Southwestern Bell Telephone. He also is a director of Washington University, St. Louis.

Victor C. Allen, of Joplin, Mo., was elected chairman of the Tri-State section of the **A.I.M.E.** at the regular January meeting of that body. **G. E. Abernathy,** of Pittsburg, Kan., is the new vice chairman and **James K. Richardson** is secretary-treasurer.

B. M. O'Harra, formerly research metallurgist for the Eagle-Picher Mining & Smelting Co., located at Joplin, Mo., has joined the metallurgical research staff of American Smelting & Refining Co. His address is Barber, N. J.

Sam Ashe, of Baxter Springs, Kan., formerly for years secretary and general superintendent of Rialto Mining Corp., has accepted a position with the F. W. Evans Mines, in the Tri-State, as general superintendent.

Alvah H. Gunnell, mining engineer, Albuquerque, N. M., has temporarily removed his headquarters to Hot Springs, N. M., in order to be more centrally located for his field work during present restrictions on transportation. He may be addressed at P. O. Box 364.

Paul Dyer Merica, vice president of the International Nickel Co., and **Essington Lewis,** Director General of Aircraft Production and Director General of Munitions for the Commonwealth of Australia, were elected honorary members of the A.I.M.E. at the regular monthly meeting of the Institute held on Jan. 21 last. The citations were for leadership in physical metallurgy and for attainments in mining engineering, respectively.

Charles A. Mitke, consulting mining engineer and vice president of the Masbate Consolidated Gold Mining Co., of Manila, P. I., and Mrs. Mitke, have been officially reported by the State Department as prisoners of the Japanese at Manila. Mr. Mitke has been in the Islands for several years engaged in consulting work and just prior to Pearl Harbor had accepted an appointment as consulting engineer for the Metal Reserve Co. in the office of the United States High Commissioner at Manila. Further information concerning Mr. and Mrs. Mitke, if available, may be obtained from L. C. Grant, 1550 West Washington St., Los Angeles, Calif.

Thomas Chalmers, recently vice president in charge of manufacturing operations for Tennessee Coal, Iron & Railroad Co., Birmingham, Ala., assumed the duties also of vice president in charge of materials on Jan. 1. As his assistants in this new work, **A. B. Haswell,** formerly assistant to the vice president in engineering and construction, has become assistant vice president in engineering and construction; **R. E. Kirk,** formerly general superintendent of coal mines, has been made assistant vice president in charge of raw materials; and **J. M. Spearman,** formerly general superintendent of Fairfield Steel Works, is now assistant vice president in charge of manufacturing operations. **N. L. Van Tol,** previously works manager at Fairfield, Ala., has been assigned exclusively to the duty of post-war research looking to the planning of peacetime developments and economics of the company under the direction of the president. **Robert Gregg,** vice president of the company, in announcing these appointments, said: "Of vital importance to the war effort of this nation is zinc. Our company for a number of years has directed the production of zinc concentrates by the Universal Exploration Co., a sister United States Steel Corp. subsidiary, at Jefferson City, Tenn. This work has been under the direct supervision of **C. E. Abbott,** vice president in charge of raw materials of both Tennessee Coal, Iron & Railroad Co. and the Universal Ex-

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ploration Co. Due to expansion of the Universal Exploration Co. for development of additional tonnage of zinc concentrates at both Jefferson City, Tennessee, and Gouverneur (St. Lawrence County), New York, Mr. Abbott will devote his entire time to that company's affairs."

OBITUARY

Gwynne Harris Sharrer, manager, French Gulch Dredging Co., died on Jan. 4 at French Gulch, Calif.

Daniel G. Longtin, mining engineer and diamond drill contractor, died in San Francisco, Calif., on Jan. 4.

Roy R. Moore, consulting mining engineer and geologist, died in Oakland, Calif., on Dec. 14, 1942, at the age of 69.

Frederick M. Radel, superintendent of Mt. Hope Mines, at Rockaway, N. J., for 15 years, died at that community on Jan. 20 at the age of 58.

Carroll M. Carter, 71, and president of the Carter Mines Co., near Ohio City, Colo., died recently in Gunnison, Ohio. Carter was widely known among the mining operators, and kept his property among the leaders of the State.

Dr. Walter V. Rohlffs, well-known San Francisco mining engineer, died in San Francisco, on Jan. 6 at the age of 65. Dr. Rohlffs was a graduate of the University of California and the Mining School at Freiberg, Germany, and a member of the A.I.M.E. and San Francisco Engineers' Club.

Charles T. Harris, for many years employed by the Cia. Minera Peñoles, S. A., and prominent in Mexican mining circles, died, aged 76 years, of pernicious anemia at his home in Mexico City on Dec. 28. A native of Pool, Cornwall, England, Mr. Harris came to Mexico when a young man and engaged in mining.

Dr. Henry Mace Payne, mining engineer and industrialist, died at Los Angeles on Jan. 7. He was 65. Dr. Payne was a graduate of McGill University and was once a field secretary of the American Mining Congress. For several years before the revolution, he was chief geologist for the Russian government.

Frank Schirmer, well-known mining operator, and who formerly owned the Gunnell mine, at the north end of the Argo tunnel, in Colorado, and also principal owner of the Argo tunnel enterprise, died on Nov. 17, at Brookline, Mass. From 1905 until 1911 he was associated with Sam Newhouse in the Boston Consolidated Mining Co.

Myron Reed Walker, mining engineer and mineral economist of the United States Tariff Commission, died in Washington, D. C., on Jan. 5. Mr. Walker had been with the Tariff Commission since 1923. He was born in Milwaukee, Nov. 25, 1880, and was educated at Colgate University and at the Michigan College of Mines. He was mine superintendent and consulting engineer in Mexico from 1904 to 1911. In 1911 he went to South America and served as a mine superintendent in Peru, Bolivia, and Argentina. He returned to the United States in 1921. After two years of consulting practice in Pittsburgh he entered the government service.

Frank E. Horton, for more than 35 years one of the most widely known of Nevada mine owners and operators, died on Jan. 18 at the age of 73. Coming to Goldfield from Colorado around 1904, Mr. Horton acquired the Daisy mine, on the Diamondfield ridge, and produced a substantial quantity of high-grade shipping ore. For some 15 years he held title to the Electric claims at Weepah, where, in 1927, his son's discovery of an outcrop of rich ore resulted in a stampede. Later the property produced heavily from open-cut mining. He had been producing gold ore from his Marigold mine, near Valmy, Humboldt county.

Donald E. Cummings

An Appreciation

DONALD E. CUMMINGS, Director of the Division of Industrial Hygiene of the University of Colorado, was fatally injured in an airplane crash near Salt Lake City, Utah, in late December.

The loss of Don Cummings was a distinct blow to the mining industry and to all those persons employed therein. For years he had worked tirelessly toward improving working conditions within our industry. The logic of his arguments has proved correct in countless cases by future events. He foresaw the social trends of the present, and, realizing their significance, worked incessantly with mine management so that their "house could be in order."

Don's interest in our industry was not based on monetary considerations. He was a true humanitarian whose boundless energy in behalf of his fellow man knew no limits. No man could have done more toward making those whom he contacted conscious of the industrial hazards presented the workman in the mining industry. In combating these hazards he made engineering a real and vivid adjunct to medical knowledge. His revolutionary thoughts on employee health were presented so sincerely and honestly that even the most skeptical was convinced of their practicability.

Don Cummings had the common touch! He spoke the language of the mucker as well as that of the king. All who knew him had confidence in his ability and integrity. He was loved and known by his friends as a man who brought reality to dreams. His sparkling personality, intelligence and enthusiasm brought hope and cheer into the homes of hundreds of workmen whose ambitions had been blasted by injury or disease.

Don Cummings was a leader of men—a man of vision, enthusiasm, intelligence and genuine native ability. Men who know the icy winds of Colorado's snows or Michigan's coastal plain will miss Don no less than those men knowing Nevada's torrid winds. He was a friend of all mankind and a true servant, in this way, of our Lord.

JAMES K. RICHARDSON

Picher, Okla.

J. H. Curle

An Appreciation

J. H. CURLE, notable member of the mining profession and distinguished writer, died at Victoria, B. C., on Dec. 26, 1942. He had been ill for four months. In July he was on his way to Aklavik, at the mouth of the Mackenzie River, and had reached Edmonton when illness compelled him to return to Victoria.

In one of his many books, "This World of Ours," he gives some autobiographic details, from which we learn that as a boy, accompanied by a tutor, he sailed around the Cape of Australia. After his return he went to South Africa and visited both the gold diggings at Barberton and the diamond diggings at Kimberley. So he made his first acquaintance with mining operations. When he returned home from this second journey, he was 16 years of age. His education was furthered at St. Andrew's University and then at Cambridge. When 20 years old, he went to South Africa, this time not a tourist but a worker. He worked underground for a while and then became an overseer or shift boss.

Later he became manager of a coal mine in the Transvaal, and learned the importance of reducing costs. His experience was varied and he added steadily to his stock of information by traveling into Rhodesia. As mining reporter for the Johannesburg *Star*, he obtained access to the mines of the Rand and likewise began to develop his ability as journalist. After six and a half years in the Transvaal, and rovings over South Africa, he started in 1897 on a tour of the world, at the age of 27. Backed by retainers, he examined mines in many countries. One result of these investigations was the publication, in 1902, of his book "The Gold Mines of the World." This made his reputation. He became Mining Commissioner to the London *Economist*, and in this capacity contributed articles to that important weekly periodical. Articles by him appeared also in the leading mining journals, to be read with keen interest and respect by those engaging in mining all over the world. A man of inflexible integrity, he was scrupulously truthful, and therefore altogether reliable. Early in his career he developed unusual ability as an appraiser of mines. No member of the mining profession was his superior in this regard. Given the facts, he judged the management, the character of the lode, the prospects of the mine, and came to a conclusion, in which he was correct with remarkable frequency. He backed his well-considered opinion and speculated in mining shares successfully, thereby eventually becoming a man of wealth.

Basically he was humane and kind hearted. He loved to play the host lavishly to his friends. Scottish in some of his traits, he was, as many Scots are, a most generous man and persistently kind to his friends or to those needing help. In the early days of the war he called on Lord Tweedsmuir, the Governor General of Canada, and gave him $250,000 for the Cause, the cause of England, now the cause of the United Nations, of civilization against savagery. Herbert Curle will be mourned all over the world, around which he traveled so many times in pursuit not of money but of knowledge and experience.

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New Books

LATIN AMERICA: COUNTRYSIDES AND UNITED REGIONS. *By Robert S. Platt, Whittlesey House, McGraw-Hill Book Company, New York, N. Y. Pp. 564. Price $5.*

TO QUOTE from the author's preface concerning the purpose of this volume: Its aim is "to record fundamental details that seem to give character to the regions." To all who have special interest in the territory embraced in the title, be it commercial, agricultural, or mining, Mr. Platt's work will prove of practical value. In fact, it is a guidebook of the regions discussed. Its appearance is opportune at a time when not only technical journals and trade papers but daily newspapers devote an increasing amount of space to Latin America. The author describes in detail the economic, political, and physical geography of representative Latin American communities, mostly rural, and gives a comprehensive picture of our neighbors to the south—the actual conditions of climate or soil which affect a group, how each person makes a living, and how the people are ruled or rule themselves. He deals briefly with each country as a whole and then presents individual sketches, as for instance a hacienda in the Central Plateau of Mexico, a farm in Baja California, the San Rafael silver mine, near Pachuca, Mexico, a farm in the highlands of Guatemala, a timber tract in the interior uplands of Panama, bauxite mining in the Guianas, oil fields in Venezuela, a placer gold mine in Colombia, Milluni tin mine in Bolivia, and numerous others. Of particular interest is the author's description of regions lying on or below the eastern slope of the Andes, the real frontier region or *tierra inexplorada* of South America, and agricultural and living conditions prevailing therein.

THE PIROTECHNIA OF VANNOCCIO BIRINGUCCIO. *Translated from the Italian by Cyril Stanley Smith and Martha Teach Gnudi. Publication sponsored by the Seeley W. Mudd Memorial Fund, American Institute of Mining and Metallurgical Engineers, 29 West 39th St., New York, N. Y. Pp. 476. Price* $5.

THOSE WHO DERIVED PLEASURE and satisfaction from the translation of Agricola's De re Metallica, by Mr. and Mrs. Hoover, will be glad to learn of this new translation of a classic on metallurgy that appeared sixteen years earlier than Agricola's better-known work. Biringuccio's book was published in 1540, and was the first to attempt to cover the whole field of metallurgy. If it has enjoyed less popularity than Agricola's treatise, this is probably due to the fact that the latter was written in Latin, the scholarly language of Europe. But this distinction now bids fair to be removed by the present authors' translation of the Pirotechnia. Dr. Gnudi made the translation at the request of Dr. Smith, research metallurgist for the American Brass Co., who then edited it in the light of his scientific knowledge.

Biringuccio was the practical metallurgist of the sixteenth century, and his book reflects the state of his art at that time. In his writings he distinguishes clearly between what he knew and had done, on the one hand, and hearsay on the other. He was free from the superstitions that afflicted many early workers in science, and he had a healthy skepticism about alchemy. Of the art of making gold he wrote: "The more I look into this art of theirs, so highly praised and so greatly desired by men, the more it seems a vain wish and fanciful dream that it is impossible to realize unless someone should find some angelic spirit as patron or should operate through his own divinity."

In addition to extensive treatises on the occurrence, mining, assaying, and treatment of ores and minerals, Biringuccio gave attention to alloys, the art of melting and casting, and the manufacture of metal products of gold, copper, iron, pewter, and others. His style is quaint and rather verbose, but the translators have produced a readable book that will repay the perusal of metallurgists.

THE ORGANIZATION AND TRAINING OF INDUSTRIAL FIRE BRIGADES. *By Capt. John C. Klinck, Memphis Fire Department, S. C. Tooff & Co., Memphis, Tenn. Pp. 119. Price $1.*

THE PROTECTION of industrial plants, including mines, mills, and smelters, against loss by fire, always important, is doubly so at a time when labor and materials for reconstruction are scarce and when production is vital to the national safety. This booklet is a foundation for a basic course of training for an industrial fire brigade, and as such should be of particular interest to the many operations of the mining industry which are not within easy reach of a public fire department. Chapters on sabotage and on handling of incendiary bombs are included.

THE MINERAL INDUSTRY DURING 1941. *Vol. 50. Edited by G. A. Roush. Published by McGraw-Hill Book Co., 330 West 42nd St., New York. Pp. 735. Price $12.*

COMPLETING A HALF-CENTURY of uninterrupted publication, this annual review is the only volume to attempt a survey of the mineral industries for the year 1941. Although handicapped by the war, which made it difficult to obtain records of production and entailed delay in publication, the editor has, nevertheless, presented a creditable piece of work that will be the more welcome by reason of its unique position in statistical records.

The customary annual reviews of commodities are prefaced by a fifty-year survey of the major metals, minerals, and fuels, with observations on war gains and losses by the Axis powers and the United Nations.

PEACE PLANS AND AMERICAN CHOICES. *By Arthur C. Millspaugh. The Brookings Institution, Washington, D. C. Pp. 107. Price $1.*

ONE DOLLAR spent for this little volume will provide more thought-provoking material on peace plans than can be found in any other package, large or small. It should not be read with the expectation that the author will offer a final solution. On the contrary, he merely provides food for thought, the digestion of which he hopes will enable the reader not only to comprehend the knotty problems involved in peace proposals, but also to reach some conclusions of his own. Thus, the style of treatment is unique: about a dozen plans are briefly explained, each followed by arguments for and against it. Do you favor plans dominated by American leadership, mastery, or balancing of power, or do you lean toward a British-American alliance, an Anglo-American federal union, a union of democracies or cooperation among the United Nations? How about regional arrangements, in the Western Hemisphere, for example? Would you revive the League of Nations or create some other form of international association that would "have more teeth"? And what about a "cooling off" period after the armistice before the details of peace are arranged? Each proposal is ably defended and attacked, but none is sponsored by the author. He wants the reader to do some intelligent thinking.

ORE DEPOSITS AS RELATED TO STRUCTURAL FEATURES. *By the Committee on Processes of Ore Deposition, National Research Council, W. H. Newhouse, chairman, et al. Princeton University Press, Princeton, N. J. Pp. 280. Price $6.50.*

A SYMPOSIUM by a group of 65 contributors, including most of the better-known present-day mining geologists. The work is valuable for bringing together concise, up-to-date descriptions of a number of important mining districts, with particular emphasis on the relationship between ore deposits and rock structure. However, despite the indisputable importance of structural conditions in facilitating and localizing ore deposition, the classification based on structural analogies is unconvincing, as it throws together deposits which are unlike in most other respects. The book is excellent material as a tributary text or collateral reading for advanced students of ore deposition.

Reflections from Washington

Washington News Bureau

A STEP WAS TAKEN toward giving mining its proper place in the sun when WPB's new Minerals Resources Coordinating Division was established with Howard I. Young at its head. The action fell short of giving complete responsibility and claimant agency status in mining matters to one man, as was done in the case of power when J. A. Krug was made czar with the establishment of the Office of Power Director. Nevertheless, the move has given a unified command for the purpose of coordinating the efforts of the many government agencies dealing with mining problems.

Mineral Resources Coordinator

WITH HIS APPOINTMENT, Mr. Young became the possessor of four titles. He is director of the Mineral Resources Coordinating Division, for which Wilbur Nelson, formerly chief of the Mining Division, was named deputy director. The new agency is a division of the Resources Bureau—formerly called the resources agencies—in the office of the program vice chairman. The functions are staff (i.e., executive).

The second title is director of the Minerals Bureau, a position Mr. Young was given when J. M. Scribner took an advisory position higher up in the organization.

The third title is that of chairman of the Minerals and Metals Advisory Committee. In this committee eleven agencies are brought together to work out a program. The agencies that are represented are Army, Navy, Board of Economic Warfare, R. F. C., Bureau of Mines, U. S. Geological Survey, Bureau of Foreign and Domestic Commerce, and in WPB, the Office of Civilian Supply, Office of Production and Research Development, Facilities Bureau, and Labor Production Division.

The fourth title is that of chairman of the Mineral Resources Operating Committee. This is composed of representatives of the Department of Interior, Reconstruction Finance Corporation, Office of Production Research and Development, and the Board of Economic Warfare. This committee determines "how," while the Minerals and Metals Advisory Committee determines "what." In both committees the members are there in an advisory capacity. The power to act is vested in the chairman.

These changes give the mining industry a spokesman in the high councils of the War Production Board as predicted last month (*E.&M.J.*, Jan. p.41.) Although this imposing list of functions seems at first blush sufficient to be burdensome, the grouping of mining affairs under an experienced and highly respected member of the industry can hardly be productive of anything but benefit.

High Preference Ratings

PREFERENCE RATINGS for mine maintenance and repair and for new equipment were increased again in January. Metal, non-metallic, and coal mines operating under Order P-56 serial numbers now use the AA-1 rating—highest there is except for the emergency triple-A—for all repair items. All new equipment orders are eligible to an AA-2X rating.

Manufacturers, too, shared in the up-rating of equipment essential to keep the nation's mines operating at full tilt. For 50 percent of their materials, manufacturers now are entitled to an AA-1 rating. The other 50 percent gets an AA-2X classification. The AA-4 rating level originally assigned to a portion of mine quotas for the first quarter is eliminated entirely by the new action.

Mines which have orders scheduled for delivery in the first quarter are urged to re-rate them with manufacturers, using the AA-1 for repair items and the AA-2X for new equipment. Manufacturers likewise are permitted to re-rate any outstanding orders for raw materials. In addition, manufacturers have been allotted increased amounts of carbon and alloy steel, copper, copper-base alloys, and zinc for production of both new and repair equipment for the mines.

The procedure under which mines, smelters, and refiners will get their maintenance and repair materials and operating supplies has been simplified. Second-quarter applications made by mines with serial numbers under P-56 are to be made on the PD-400 forms. This is for all mines whether their requirements for the quarterly period amount to more than $5,000 or not. Smelters and refiners with serial numbers under P-73 will use the PD-760 form for the same purpose. Form PD-25-A, one of the industry's greatest headaches, has been abandoned for mines and smelters.

Controlled Materials Plan

CLASSIFICATION OF ITEMS in Class A or Class B of the Controlled Materials Plan is of no importance to the mines. The mine-machinery manufacturers have to worry about that in order to get their materials. All the mines have to do is to fill out the applicable PD-400 form and send it in before the deadline that will be specified when they receive their forms. The CMP forms requesting "Bills of Materials" which were mailed to mines and smelters some time ago may be disregarded.

Marking Time on Manpower

COMING, although possibly not soon, is a major Washington battle for a National Service Act, including both men and women, which would allow drafting of workers for jobs on the home front as men are now drafted for military service. Several alternative proposals will be before Congressional committees when the subject is taken up, including the bill of Senator Austin, Vermont Republican, patterned after the principles outlined by Grenville Clark, New York attorney and personal friend of the President.

Early in February, McNutt issued a "work or fight" order, requiring that men between the ages of 18 and 38 in a list of occupations rated as non-essential must obtain jobs in essential industries by April 1 or be drafted for the Army, regardless of their dependency status.

Although McNutt has made no secret of his conviction that voluntary methods won't work, when the Austin-Wadsworth bill was introduced on Feb. 8, he sidestepped a political "hot potato" by declining to comment on the bill or the need for a National Service Act.

Again, Ickes

SECRETARY ICKES brought into the open in January his long continuing attacks on the War Production Board for its administration of mineral industry problems. The secretary was blunt in his inferences that WPB's industry men were responsible—"It may be that if we freed technology from the restrictions of interlocking

corporate control and the ideology of monopoly, we would reap a harvest of new, highly efficient, and self-contained medium and small-sized operations."

Ickes said his piece before Senator Murray's Small Business Committee, under questioning by the chairman. The questions were pointed and the answers were detailed, it being obvious that both questions and answers were "canned" in advance. Attempts by Interior Department men to "force" increased production of metals and minerals with processes they have worked out "in years of study" usually "peter out, somehow, in WPB," Ickes said.

A few weeks later, on Jan. 30, Senator Murray sounded off in the same vein in a speech during the annual meeting of the Colorado Mining Association, in Denver, by bitterly criticizing "inadequacies" of WPB mineral policies and an "impervious layer of bureaucrats" who "throw the ball to each other" in giving the small miner "the run-around."

Discounting the harsh viewpoint as to both sides of this controversy, that WPB men are unduly loyal to big business interests on the one hand, and that the Ickes-Murray speeches avoid the exigencies of wartime in their careful cultivation of popularity on the other, what the dispute really points up is the lack of a coherent manpower policy in the government. WPB has been proceeding, as Henderson did, on the assumption that the Administration intends to back up some of the tall talk that has emanated from high officials about total war and total mobilization. If the manpower problem is to be as pressing and as firmly administered as we are being told, WPB is probably correct in refusing to sanction the use of manpower and materials in the utilization of less efficient sources of production, and Ickes and Murray are "off the beam." However, if manpower is available in sufficient quantities to permit the continuance of many luxury trades, union extravagances, and excessive absenteeism in war plants, Ickes and Murray are justified in sponsoring its diversion into production of metals and minerals from less efficient sources.

Mining Loan Procedure

Reconstruction Finance Corp. has abandoned its "class" system of government loans on mining undertakings. Mining prospectors and operators now simply need to file an application setting forth their proposed project; RFC experts will evaluate the application and determine the risk the government is willing to take. The new procedure is outlined in detail in Circular No. 14 (Revised), issued in January, and makes the directions given in *E.&M.J.* last month (p. 62) obsolete. Applications will be considered from any owner or lessee of a property or from one with authority to mine orebodies for any of the following purposes: to unwater, retimber, and otherwise make ore accessible for examination (up to $5,000); for development of properties, for construction, improvement or repair of mills, smelters, refineries, dredges, etc.; purchase of equipment, etc.; and to provide working capital. Purposes for which loans will not be authorized include purchasing mineral acreage, prospecting mineral deposits, developing treatment processes, for purely promotional purposes, or to pay outstanding indebtedness.

Interest rates will be 4 percent. Applications forms are available from any loan agency or mining section field office or direct from RFC in Washington and may be filed at any of these same places.

Silver Row Due

THE SILVER ISSUE begins in the new Congress exactly where it left off in the old. Legislation to repeal the 1943 Silver Purchase Act, under which all domestic production is purchased by the Treasury at 71.11c. an ounce, has been introduced by Representative Daniel Reed, New York Republican. Senator Theodore F. Green, of Rhode Island, is again sponsoring his controversial measure to permit sale of "free" Treasury silver at less than the 71.11c. purchase price for commercial use as metal. The Green bill was filibustered to death at the tag end of the previous session, and the silver repealer never emerged from committee.

Countering the efforts of the antisilverite group, five of the silver-states senators in a joint statement at the end of the year set forth their position as follows: In favor of release of 47,000 tons of unpledged bullion for allocation by WPB at a price of 71.11c. an ounce; in favor of loan for allocation by WPB of 40,000 tons pledged silver for nonconsumptive use (busbars, etc.) and in favor of sale of new domestic silver not needed by the Treasury under WPB allocation at 71.11c. an ounce.

BEW Takes Over

ALL PURCHASES of metals and minerals—as well as all other commodities except rubber—for import for government account will be turned over, lock, stock, and barrel, to the Board of Economic Warfare on Feb. 25. Since April, BEW has had delegated executive authority to decide what critical materials to buy, where, and at what price. But, for the most part, deals have been worked out by Jesse Jones' men from Metals Reserve Co. and similar subsidiaries of the RFC. After Feb. 25, Vice President Wallace's BEW men will do all the negotiating, leaving to RFC only the job of issuing the checks. This shift in internal operations is the latest round in the Wallace-Jones feud which was climaxed last spring when BEW got authority to tell RFC where to spend money when it comes to foreign purchases. For a while, BEW was content to let the RFC do the work under BEW supervision, but in January, when rubber czar Jeffers vested in Rubber Reserve Corp. full authority over foreign purchases of that commodity, BEW stepped in to take jurisdiction over all other purchases.

Premium Increases on Zinc and Lead

AS FORECAST in Reflections for January, changes have been made in the Premium-Quota Plan designed to afford further stimuli to domestic mine production of zinc. Further details in regard to these changes are given on page 124.

More Taxes to Come

THE END OF January was too early in the game to get a clear picture of the new Congress, which is being called the "Victory Congress" after the President's State of the Union address holding out the possibility of an armistice in 1944. Biggest war jobs presented to the Congress by the President in this speech and his budget message are those of appropriating some $109 billion to prosecute the war and run the government in fiscal 1944 (July 1, 1943-June 30, 1944), and of finding ways to meet FDR's call for paying 50 percent of the war cost as we go. This means $16 billions in taxes added to the estimated $31 billions which existing laws would produce. Increased withholding taxes, a sales tax, and probably stepped-up social security deductions all seem to be in the cards.

There was little doubt that the President's requests for some $100 billions in war funds will be voted. But there will be acrimonious debate before many of the Presidential proposals for non-direct war-time appropriations are approved. These funds to run the government are two and a half billion below the 1939 budget—but they are still two-and-a-half billion above the 1932 level.

Legislation "catching up" income taxpayers to a current, instead of a year-lag, basis is earmarked for early consideration, but Congressional leaders in January were moved to point out that regardless of the fate of the Ruml Plan or any substitute for it, more than 27,000,000 Americans still will owe a tax payment on March 15. Too many people were getting the idea that "forgiveness" of the 1942 tax would mean a tax vacation.

(*Continued on page* 150)

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NEWS OF THE INDUSTRY

Alcoa Announces New Process for Alumina

ALUMINUM COMPANY OF AMERICA recently announced the development of a new process which makes possible the extraction from lower grades of bauxite of as high a percentage of alumina as was formerly obtained from high-grade ore. The new process culminates 25 years of research, particularly intensive for the past five years, and affords a practical method of treating impure ores formerly regarded as commercially unsuitable. It is considered highly important in meeting the war requirements for aluminum, and as a measure to conserve the domestic deposits of high-grade bauxite. The new Defense Plant Corporation refining plant, built and operated by Alcoa in Arkansas, is designed to use this process. The announcement was made in connection with award of the Army-Navy "E" to the company's mining operations in Arkansas, alumina conversion plant in Alabama, and aluminum reduction plants in North Carolina and New York State.

NOTICE TO SUBSCRIBERS

READERS of *Engineering and Mining Journal* will observe that the "trim size" of the current issue of the magazine is slightly smaller than that of previous numbers. The reduction in size has been made to enable the publishers to meet an order of the War Production Board limiting the amount of paper that may be used in 1943. Subscribers will note, however, that no change has been made in size of type or in the amount of editorial content per page, but that a substantial saving in paper has been effected merely by trimming the margins.

The publishers have adopted the new size as a war measure and as a contribution to the conservation of manpower and transportation facilities in the production and distribution of paper. Service to the reader has not been sacrificed and will be maintained as far as humanly possible in the face of the problems confronting all of us in our united efforts to win the war.

Premium-Quota Plan to Permit Larger Zinc-Lead Subsidies

Zinc and lead miners may get double and single increase, respectively, at discretion of Quota Committee, to encourage greater zinc output—Copper unchanged

THE PREMIUM-QUOTA PLAN, jointly administered by the War Production Board, Office of Price Administration, and Metals Reserve Co., has been expanded, effective Jan. 1, 1943, to encourage greater production of zinc and establishment of new zinc ore reserves. Also, the guarantee period has been extended for one year to facilitate investments that cannot be expected to pay out in the year and a half remaining as the duration of the original plan.

As amended, the plan now permits the WPB-OPA Quota Committee, composed of representatives of the copper, zinc, and lead branches of WPB and of the non-ferrous metals division of OPA, to grant "B" and "C" premiums of 2¾c. each in addition to the original premium of like amount, now called the "A" premium level. These premiums are available, at the discretion of the committee, to zinc ore and concentrate producers whose costs or capacities to increase production warrant the granting of increased operating income.

A "B" premium of similar amount is also available to lead ore and concentrate producers under similar conditions. Presumably, however, in view of the lesser position of lead in the war economy and of a comparatively easy situation in regard to supplies, the lead increase may be regarded as primarily for the purpose of facilitating more zinc output from lead-zinc ores. No change has been made with reference to copper, except the extension of time.

Thus, the Quota Committee is provided with a flexible system of subsidizing high-cost producers to the extent necessary to keep their operations functioning, within combined price-premium limits of 17c. per pound for copper, (Connecticut Valley), 16½c. for zinc (St. Louis) and 12c. for lead (New York). The subsidy limits, apart from prices, are 5c. for copper, 8½c. for zinc and 5½c. for lead. Neither the old nor the new plan offers price guarantee.

As announced in November, in order that settlements shall not be held up pending actual milling or smelting of the miner's shipments, but can be made as soon as assays are determined, the plan now operates according to presumed rather than actual recoveries. Presumed recoveries are as follows.

	Ore Shipped to Custom Mill or Waelz Plant	Concentrate to Copper Smelter	Concentrate to Lead Smelter	Concentrate to Zinc Smelter
Percent of copper content....	87	97	85	70
Percent of lead content.....	86	70	95	60
Percent of zinc content.....	77	none	none	90

Note: As in the past, Tri-State premiums will assume a 60 percent content for zinc concentrate and an 80 percent content for lead concentrate.

The original plan was effective for two and one half years from Feb. 1, 1942, but has now been extended to run for an additional year. The bases for cash settlement, optional with Metals Reserve, in the event of the war's end, are unchanged, except for the extension of time.

Anaconda Copper Receives Army-Navy "E" Award

THE coveted Army-Navy "E" award, granted in recognition of extraordinary efforts in the production of materials or implements of war, has been granted to two more Anaconda Copper plants, the copper smelter at Anaconda and the electrolytic zinc plant at Great Falls. The ceremony at Anaconda took place on Jan. 228 and that at Great Falls occurred on Jan. 29.

Mexican Trade Agreement Effective Jan. 30

THE EFFECTIVE DATE of the Mexican reciprocal trade agreement lowering the import duty in lead, zinc, molybdenum, and fluorspar, and freezing the duty on amorphous graphite at 5 percent, is Jan. 30, 1943, according to the Department of State.

Copper Mine Revived in Central Oklahoma

A COPPER DEPOSIT, three miles east of Prague, Okla., first opened up in 1920 by E. G. Eby, of Wagoner, has been reopened for the third time by T. J. Pate, mining engineer, whose office is in Prague. The deposit is described as a small vein—apparently of quartz, as it is described as containing a fluxing element valuable for smelting—averaging 26 percent copper, and carrying gold and silver. Other attempts to work the deposit occurred in 1930-31 and in the summer of 1934. The first shaft, which was deepened by the second operator, A. C. Frampton, of Sapulpa, to 76 ft., was not used by the third, W. R. Jarrett, who sank a second shaft to a depth of 50 ft.

Aside from its economic aspects, this deposit is of geological interest because the mineralogy suggests igneous intrusive activity in the midst of a broad area wherein other evidence of such activity is unknown.

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This is how the MULTICLONE simplifies installation and saves space

FOR recovering suspended materials from gases, no other mechanical collector can match the advantages of the MULTICLONE. It is the result of over 36 years of concentrated research and development in the science of recovery and incorporates many exclusive advancements that reduce installation costs, increase operating efficiency, save valuable space and greatly simplify maintenance and inspection.

[**FOR EXAMPLE** . . . *the patented vane design of MULTICLONE tubes eliminates need for the complicated manifolding and costly multiple ducts of conventional side-entry cyclones. This important advancement permits any number of tubes to be compactly installed in small areas,* **using only ONE inlet and ONE outlet header.** *In addition, the particles removed by an entire bank of tubes are collected through* **one** *unitized hopper, further simplifying installation and operation over the conventional multiple hopper arrangement.*]

Advantages are many. The smaller surface exposed to the gas minimizes erosive wear, and because all tubes can be quickly reached through a single manhole, maintenance is easy and quick without dismantling entire unit. • Heat radiation is reduced to a minimum by the simplified header construction, improving temperature control and reducing costs of insulation. • The great saving of space permits MULTICLONE installation in existing structures where manifolding would be impossible—and in all new structures where space is valuable.

These are only a few of the *many* engineered advantages that are yours when you install a MULTICLONE. It will pay you to get the full story before you install *any* dust recovery equipment!

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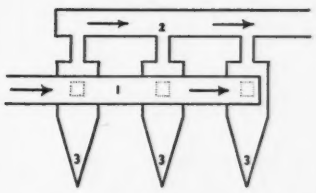
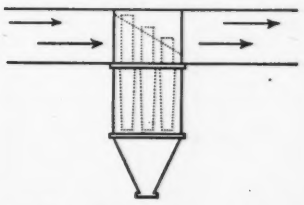
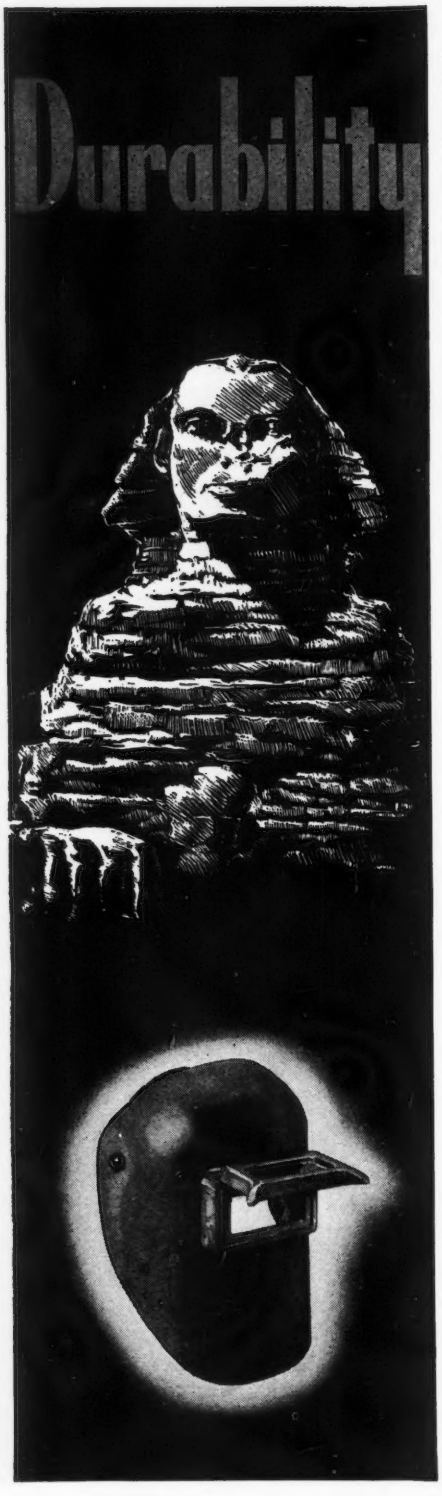


▸ **Conventional Cyclone Collector** design uses side entry of gas to produce centrifugal whirling action. This necessitates costly and complicated manifolding of inlet and outlet ducts (1 & 2)—is space-wasting and difficult to insulate. Individual hoppers (3) further complicate installation and maintenance.



▸ **In the exclusive Vane Type MULTICLONE** design gas enters tubes through one simple manifold chamber that reduces duct work to a minimum and permits compacting many tubes into an extremely small space. In each tube, *(right)* vanes then whirl the gas into eight miniature cyclones, giving more complete distribution of gas and higher dust recovery. Cleaned gas can be discharged either horizontally or vertically from a *single* outlet . . . and *one* dust hopper handles recovery from many tubes simplifying installation and maintenance requirements.



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Commission to Investigate Bolivian Tin Problems

ABOUT the middle of January, a commission of five persons, representing the public, employers, labor, the Board of Economic Warfare, and the Office of the Coordinator of Inter-American Affairs, departed for Bolivia to make an investigation into Bolivian tin production problems.

The mission is believed to be, at least in part, a consequence of charges by Ernesto Galarza, labor representative of the Pan-American Union, that the United States Ambassador to Bolivia, Pierre Boal, had urged that the President of Bolivia should not endorse an increase of wages to Bolivian tin miners. The State Department denied the truth of these charges, stating that Mr. Boal merely asked what the effect of the proposed wage increases would be on the price of tin concentrates. All Bolivia's tin concentrate production is being purchased by the United States for smelting in its new Texas plant.

Charles Hook, Jr., of the American Rolling Mill Co., represents employers on the commission and Robert Watt, of the A. F. of L., represents labor.

In mid-January, Luis Suaznabar, publisher of *Las Noticias*, a newspaper of Oruro, Bolivia, expressed the opinion that Bolivia could increase its tin production if more mining machinery could be spared by the United States for Bolivian use. The journalist had just completed a three-month tour of the United States as the guest of the Department of Inter-American Affairs and the National Press Club.

Dissension Breaks Out in Mining Union

ACCORDING to the *New York Times*, late in January delegates representing eight Eastern locals dissatisfied with the conduct of the International Union of Mine, Mill and Smelter Workers, CIO, met in Pittsburgh to lodge charges with Philip Murray, CIO president, of irregularities in the recent election of union officers. The dissident locals, claiming to compose a majority of the union membership, insist that John Driscoll, of Waterbury, Conn., and an anti-left wing slate, would have beaten Reid Robinson, president of the International union, who, they claim, leads a Communist faction which controls the union's affairs, if the Robinson adherents had not thrown out thousands of votes cast in favor of the Driscoll slate.

"It is clear that our membership is in revolt against the attempted domination of our union by the Communists under Robinson's leadership and their efforts to subordinate all policies to the policy of building the Communist party," said William T. Moriarity, a spokesman for the Waterbury local. "We will not compromise with this issue and will insist upon the complete elimination of Communists from positions of trust and authority in our union and from the staff of the organization as preliminary to an honest election to be supervised by the national office of the C.I.O."

Though none of the members of the Driscoll group would discuss the question, it was learned that unless Mr. Murray succeeds in bringing about some satisfactory arrangement of the dispute, the Eastern locals may lead a movement for secession from the C.I.O.

Activities of Labor Board on Mining Cases

DURING THE MONTH of January the National Labor Relations Board announced the following activities in regard to mines and smelters:

The American Federation of Labor was certified as exclusive bargaining agent for production and maintenance employees of the mine and mill of Nevada Consolidated Copper Co., Kennecott affiliate, at Ray, Ariz., and for employees of the Ray & Gila Valley Railroad. This decision was pursuant to an election held by the board on Dec. 21.

Cease and desist orders were issued to three Tri-State district operations, the Davis-Big Chief Mining Co., the same company as assignee of the Skelton Lead & Zinc Co., and the Cardin Mining & Milling Co., All these companies operate at Picher, Okla. The first company was ordered to pay $38,980 to 44 claimants and reinstate 27 and as assignee of the Skelton interests to pay $9,095 to 13 claimants and reinstate eight. The Cardin company was ordered to pay $6,605.19 to six claimants and reinstate six. All of these cases are the outgrowth of an alleged strike which took place in the Tri-State district in 1935, prior to the effective date of the Wagner Act.

The board also ordered an election among employees of Bonanza Mines, Inc., operating a quicksilver property in Oregon, to decide a contest between the International Union of Mine, Mill and Smelter Workers, CIO, and Quick Silver Mine Workers, A.F. of L. Elections were also ordered to choose between the International Union of Mine, Mill and Smelter Workers, CIO, and A.F. of L. units for machinists and boilermakers of Inspiration Consolidated Copper Co., Inspiration, Ariz., and for miscellaneous units of Miami Copper Co., Miami, Ariz.

Soapstone and Scheelite in Central Texas

ACCORDING TO DR. E. H. SELLARDS, director of the University of Texas Bureau of Economic Geology, both scheelite and soapstone deposits have recently been discovered in the central mineral region of the State.

Ten occurrences of scheelite are reported, discovery having been made possible by violet-ray prospecting. However, only two of the ten are thought to be large enough to be of commercial interest. One of these is on the Llano-Gillespie county line three-quarters of a mile east of Enchanted Rock. The other is 7 miles northeast of Willow City, Gillespie County.

The talc deposits, totaling approximately 600,000 tons, are also in Gillespie County.

Need for Government Engineers More Urgent

EDUCATION AND EXPERIENCE requirements for engineers have been lowered to meet the increasing need for filling engineer positions, the Civil Service Commission announced early in January.

For the grades of assistant engineer, $2,600 a year through chief engineer, $8,000 a year, applicants either must have successfully completed a full four-year course leading to a bachelor's degree in engineering in a college or university of recognized standing; or must show professional engineering experience providing the substantial equivalent of such a course, in addition to the required experience.

One year of professional engineering experience, or of engineering graduate study, is required for assistant engineer, $2,600 a year. For higher positions applicants must show additional experience of a progressively higher level—higher in degree of difficulty and importance of work performed, amount of responsibility assumed, and extent of supervision exercised. Graduate study will be accepted on the same basis as experience, except that, in general, graduate study alone will not be considered qualifying for grades above $3,200.

Most of the positions are in the grades paying $3,800, $3,200, and $2,600 a year, and only a few positions will be filled at the higher salaries. It is contemplated filling positions in Washington, D. C., throughout the United States and its Territories and possessions.

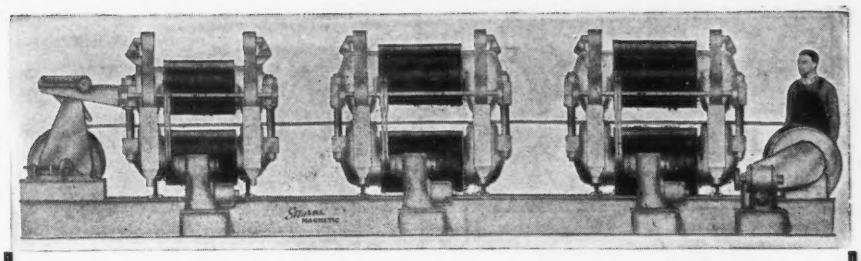
Applications will be accepted until further notice, but qualified persons are urged to apply immediately. No written test will be given, and applicants will be rated on the basis of their statements in the applications, subject to verification by the Commission.

An examination for junior engineer, $2,000 a year, is also open. For this examination no experience is necessary, and the requirements have been lowered to permit the acceptance of applications from college graduates with a degree in any field who are enrolled, or will enroll, in the Engineering, Science and Management War Training Course in engineering fundamentals, sponsored by the U. S. Office of Education.

Urge Care in Handling Blasting Caps

THE Institute of Makers of Explosives urges *Engineering and Mining Journal* to warn its readers against carelessness in handling blasting caps, particularly with respect to not leaving them around where they might possibly be found by children.

Although the number of child injuries from playing with blasting caps has diminished in recent years, the accident rate is still unsatisfactory. Adequate safety practice in all industries using explosives demands that blasting caps should be locked up at all times when not in use, and that all surpluses should be returned to storage, not left lying around.



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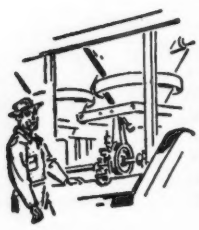

JIGS: for mechanical concentration of heavy minerals Standard equipment on gold dredges and in mill operations. Now used in modernizing tin, manganese and chrome plants.

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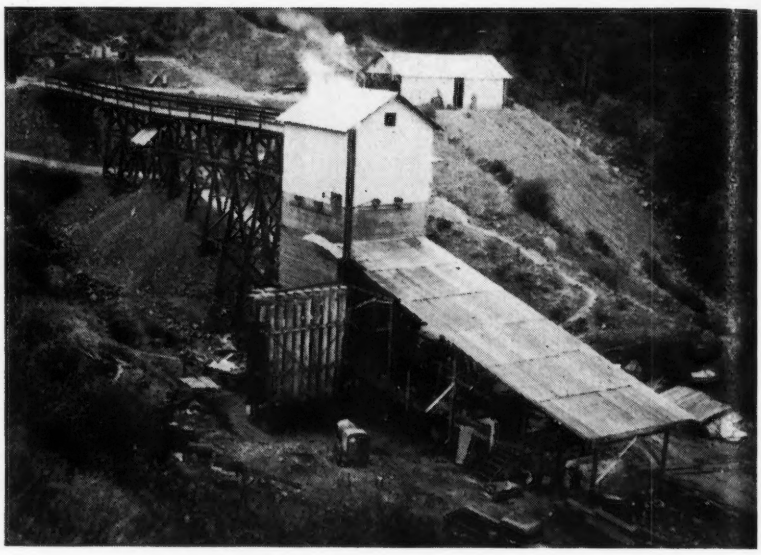
Design, Metallurgical Testing and Field Consulting Service; Manufacturers of Mill and Placer Recovery Equipment.



Santa Ynez quicksilver mine, Santa Barbara County, Calif. The 30x30 Cottrell furnace plant was formerly at Los Prietos mine

CALIFORNIA

More Gold Mines Resume Operation

Pyavin claims under development—Central Eureka headframe being moved to Nevada — To make test of Cajalco tin property

▶ Yuba Consolidated Gold Fields, F. C. van Deinse, vice president, San Francisco, has been granted permission by WPB to operate a number of its dredges at Hammonton, Yuba County, with the proviso that no men under 55 years of age be employed. Accordingly, two large dredges were placed in operation immediately after receipt of the order. The units at Biggs, in Butte County, Callahan, in Siskiyou County, and Watertown, in Merced County, remain idle. At the time of the gold mine closing order the company employed some 350 men in the different dredging fields in central and northern California. H. C. Perring is general superintendent.

▶ Development operations have been started at the Pyavin claims in Indian Wells Canyon, Kern County, by Erle P. Halliburton, Inc., following completion of a lease agreement with William Petty, of Inyokern. A compressor and other mine equipment have arrived at the property, and a bulldozer is active improving roads. The company's Morning Star gold mine, near Cima, San Bernardino County, remains closed for the duration.

▶ War Manganese Co. has started production of high-grade manganese ore at its holdings in Imperial County, with 35 men employed. The company is headed by R. M. Pike, and holds a contract with Metals Reserve for 5,000 tons of manganese ore.

▶ L. K. Requa and associates have started exploratory work, including diamond drilling, at the Polar Star quicksilver mine, in San Luis Obispo County, with six men employed. The property consists of six claims, and the outcome of current development will determine future plans. The company formerly operated the Idaho Almaden quicksilver mine, at Weiser, Idaho.

▶ Los Angeles interests headed by H. A. Sill are reported to be investigating a manganese deposit in Nevada County. Equipment moved to the site included bulldozers and other earth-moving machinery and compressor. William Tuttle, superintendent, is in charge.

▶ Permission has been granted by WPB to Original Sixteen-to-One Mines Co., to resume operations on a limited scale at its gold mine near Alleghany, Sierra County, with restrictions, as in other cases, being placed on the number and age of men employed and on production. The property is equipped with a 150-ton mill, and normally employs about 90 men. H. U. Maxfield is president of the company, and C. A. Bennett, general manager, directs operations.

▶ Metals Reserve is reported to have approved installation of equipment at the Cajalco tin mine in Riverside County, with Dodge Construction Co., to make a test run in the next few weeks. Stephan Riess, superintendent, is in charge of operations, and the company expects to employ some 30 men when operations get under way.

▶ Bradley Mining Co., of San Francisco, Worthen Bradley, president, has recently contributed some 100 tons of scrap from its Spanish mine near Washington, Nevada County. The property is currently operated under lease by Industrial Minerals and Chemical Co. and produces about 100 tons of barite a day. R. J. Penrose is superintendent, and 30 men are employed.

NEVADA

Manganese Ore Company Completes Housing

Development loan for Ralston property—Ruby Hill shaft below 500 ft. — Dayton dredge will not be moved

▶A well-appointed town of some 75 air-conditioned buildings has been completed by the Manganese Ore Co., subsidiary of M. A. Hanna & Co., of Cleveland, at its Nevada manganese mine. Estimated to cost $6,000,000 and financed by the RFC, the plant will treat 1,000 tons per day of ore from an open cut, now being mined by power shovel and trucked to stockpiles. Construction contractor is the P. J. Walker Co., of Los Angeles. Pan-American Engineering Co. has developed the metallurgy; and plant engineering was awarded to the Southwestern Engineering Co.

▶The El Dorado Rover Mines Co., having closed down its gold mine and 100-ton cyanide mill near Nelson, Clark County, has undertaken development of the Sagamore lead-zinc-silver-copper mine of the California Sulphur Co., in San Bernardino County, Calif. Flotation equipment is being installed in the cyanide mill. P. A. Keegel, of Las Vegas, is president, and J. D. McPherson, of Nelson, manager, is in charge, near Ivanpah, Calif.

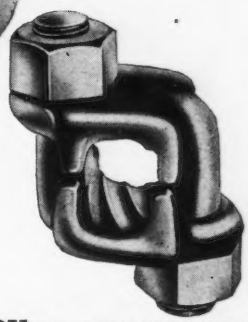
▶The 100-ton selective-flotation mill of the Rip Van Winkle Consolidated Mining Co. in the Merrimac district of Elko County has been treating 50 to 60 tons per day and shipping high-grade concentrates to Utah and Texas. Deep prospect drilling has been conducted by the U. S. Bureau of Mines and deeper mine levels are being opened. George B. Thatcher, of Reno, is president and L. S. Breckon, geologist for the Utah Copper Co., is directing the company's operations.

▶A second rotary furnace is now in operation at the Silver Cloud cinnabar mine of the New Verde Mining Co., a Newmont subsidiary in Elko County. The two furnaces are treating 120 tons per day of ore mined by power shovel from an open cut and a new pit is being opened 200 ft. to the north. Bryan R. Frisbie is manager, with office at Battle Mountain.

▶Production of fluorspar from the Vet S. Baxter property in northeastern Mineral County is to be substantially increased with completion of a highway passing near the mine and connecting the Gabbs Valley camp with U. S. Highway 50 near Westgate, in Churchill County.

▶An RFC development loan has been advanced to Ernest A. Moross, of Goldfield, to extend a tunnel on the Ralston cinnabar property, near Cuprite, 10 miles south of Goldfield. Moross has a unique mobile laboratory in a specially built truck, with assay furnace and Mitchell high-speed diamond drill, driven by high-amperage current from a 25-kw. gen-

"Save Bullet-Metal for Our Boys' Guns ... with a FIST-GRIP on Wire Rope"



"YOU can save rope, save clips — just as we do — by using Laughlin 'Fist-Grip' Safety Clips, instead of 'finger-pinch' U-bolt clips that crimp and injure wire rope.

"With 'Fist-Grip' Clips the bolts are on opposite sides — the four bearing surfaces grip like a fist, not a 'finger-pinch'. Three 'Fist-Grip' Clips do the work of four U-bolts! Design is so strong that less steel is needed in each clip. *25% less steel* in all is saved per assembly.

"I figure the rope, clips and steel saved mean more guns and bullets for our boys."

Competitive Tests Prove Greater Holding Power of Laughlin "Fist-Grip" Clips

With 4 U-bolt clips at 37,750 lbs. load, ¾" rope broke at saddle, while only 3 Laughlin Safety Clips held the same load without rope breakage, because extra bearing surfaces grip without crimping. Here's the clip that fights for your country! Investigate!

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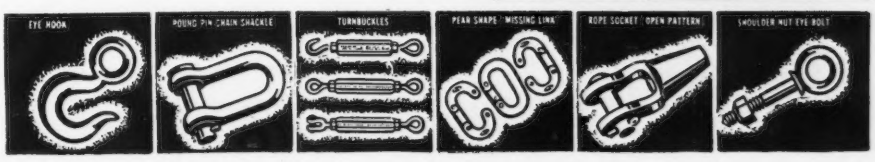
Saves Manpower

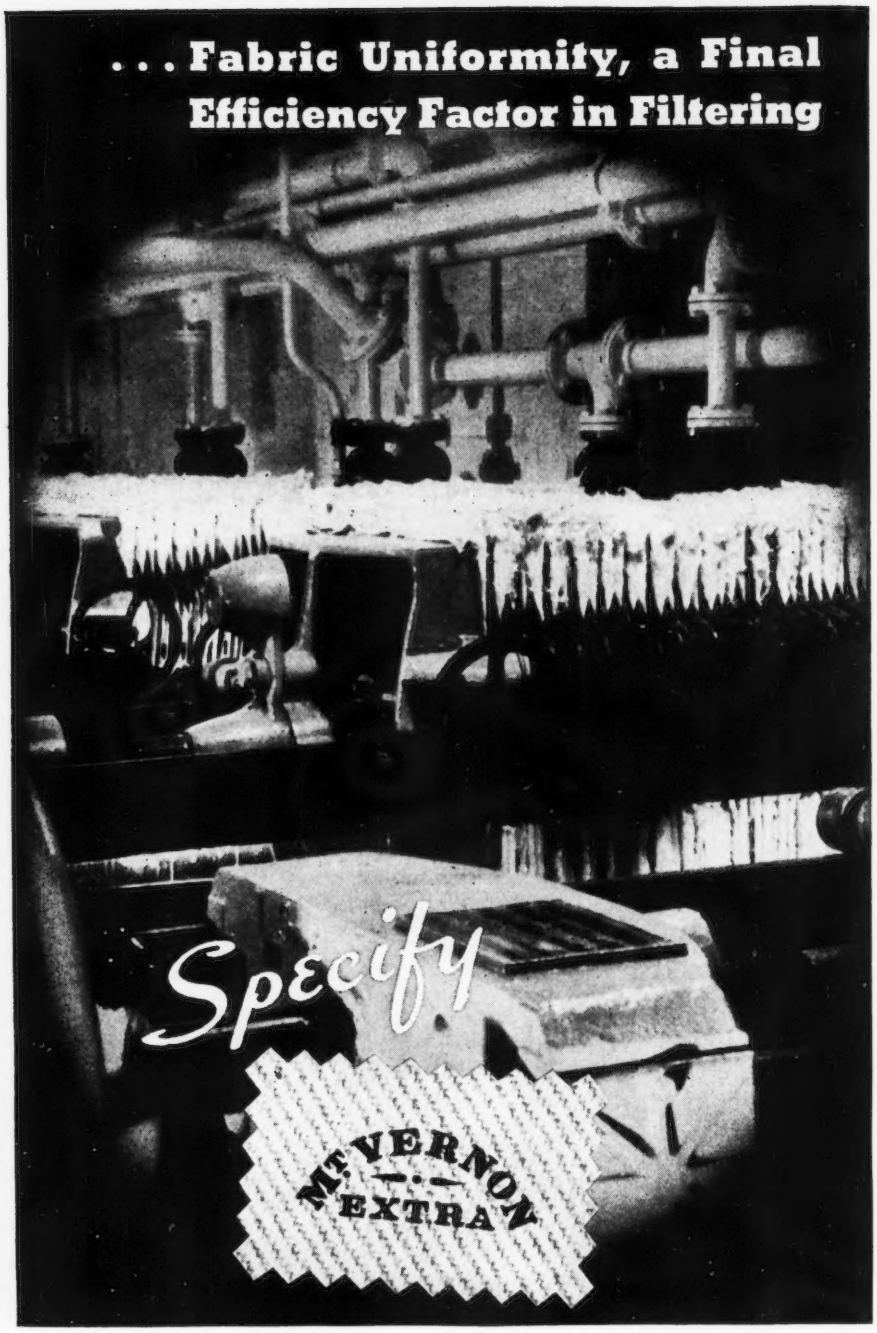
greater holding power, less work; can't be put on wrong.

Saves Metals

no special-shaped wrench, fewer clips needed, no spoiled rope, 25% less steel.

THE THOMAS LAUGHLIN Company PORTLAND, MAINE





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erator. Dual rear tires of the truck can be replaced by caterpillar treads, and a luxurious house-trailer is attached.

▶ At the old Ashdon gold-silver mine the Defense Tungsten Co., headed by J. Paul Jones, with mail office at Denio, has reconditioned the old amalgamating mill and is treating scheelite, some of high grade, mined from an open cut four miles from the mill. Wagner is directing the work.

▶ On Ruby Hill, two miles west of Eureka, a three-comparent shaft on the Fad claim of the Richmond-Eureka group of mines has reached a depth of 530 ft. and will continue to 3,000 ft. or deeper to reach lead-silver orebodies north of the Ruby fault, found in deep diamond drilling. The properties are leased for a long term by the Eureka Corporation, Ltd., subsidiary of Ventures, Ltd., with main offices in Toronto. William Sharp is directing engineer.

▶ Near the early-day gold-silver camp of Tuscarora, in Elko County, operators from Greeley, Colo., are conducting extensive prospect drilling on a copper zone marked by outcrops of gossan similar to that of the Rio Tinto mine, at the north. Fred Hungerberger is in charge at Tuscarora.

▶ For the first time during winter months, the Champion Sillimanite Co. is developing and producing dumortierite from its deposit near Oreana, Pershing County. The product, obtained in earlier years from loose surface material, is now mined through tunnels and shipped to the Detroit plant, where it is mixed with andalusite from the company's deposits near Bishop, Calif., in making spark-plug cores. The dumortierite deposit is said to be the only one known to geologists of similar volume and quality.

▶ Officers of the Dayton Dredging Co. at Dayton, Lyon County, deny reports that the dragline dredge, largest of its type in this country, is to be dismantled and the excavator, with 180-ft. boom and 12-cu.yd. bucket, shipped to Florida for work on a federal canal project. The dredge was closed down following the WPB order of October but there are hopes it may resume.

▶ All work has ceased at the cinnabar property of the McAdoo Mining Co. in the Bottle Creek district, Humboldt County, Mrs. Eva McAdoo, of Winnemucca, owner. The 40-ton Herreshoff furnace, now to be removed, was closed down last spring and a development crew was retained until recently. The near-by Greenan mine is idle.

▶ The Tungsten Associated Mines, composed of California men, is reported proceeding with construction of a tungsten mill in Lincoln County. James Pollard is manager, with office at Pioche.

▶ In the January issue it was erroneously reported that Arthur Notman, New York consulting engineer, was in charge of work at the Central Eureka Mining Co.'s Copper Queen mine, near Battle Mountain. Mr. Notman is not connected with this operation. He is at present in government work, and his headquarters are in London, England.

Wide World

Stockpile of copper busbars for the Basic Magnesium reduction plant, Nevada

IDAHO

Idaho-Almaden Mercury Mine Abandoned

Homestake developing vanadium deposits —Labor supply said to be easier—Two lead-zinc mines and one lead-silver mine being reopened

▶ The Douglas lead-zinc mine, on Pine Creek, in the Coeur d'Alenes, has been leased by the Small Leasing Co., controlled by Ellsworth Small and Leo J. Hoban. The same concern now operates a new tailings mill on Canyon Creek near Wallace. The Douglas property is controlled by the Bunker Hill & Sullivan and the Hecla Mining Co. It has been idle for many years, the last operations being in 1915, when Anaconda Copper held a lease and bond and shipped $346,000 worth of ore. Engineers estimate 100,000 tons of ore now available for extraction.

▶ The Birch Creek Mining Co., operating in Clark County near Winsper, is reported to have secured a federal loan of $20,000 to develop further the Scott group of claims. The property is a former producer. Dubois, Idaho, 35 miles from the claims, is the company's shipping station.

▶ Development of vanadium ore deposits in southeastern Idaho is under way by the Wyodak Coal & Mfg. company, a subsidiary of the Homestake Gold Mining Co., of Lead, S. D. One hundred men are now employed at the property and this number will be enlarged as soon as suitable camp accommodations can be provided. The miners are being transferred from Lead to the Idaho project.

▶ Champion mine, near Mackay, in eastern Idaho, is under development by D. E. Bell and J. L. Ausich, well-known mining men of that section of the State. Production of lead-silver ore is under way. Snow conditions have hampered transportation to the railhead at Mackay, but by use of heavy road equipment the road has thus far been kept passable for the ore trucks. Larger operations are planned for the spring and summer. Mr. Bell also has the Livingstone mine under lease and plans new work there next summer.

▶ Due to exhaustion of its ore deposit, the Idaho-Almaden quicksilver mine, near Weiser, in southwestern Idaho, has closed permanently, according to L. K. Requa, manager. The property has been a heavy producer of quicksilver for several years. Interested in the enterprise with Manager Requa were two sons of ex-President Herbert Hoover. The Almaden camp and mine buildings will be dismantled to be moved to other mining properties in California. The company is now developing the Polar Star mine, in San Luis Obispo County.

▶ The new milling plant at the Silver Crescent mine, at Bonners Ferry, northern Idaho, is now being installed and will soon be ready for use, according to President Guy Regal. The product is lead-zinc. Production is expected to start in March.

▶ Sale of the Idaho-Continental mine lease in the Porthill district, near the Idaho-Canadian boundary, to A. D. Cobb of Great Falls, Mont., was announced by Trueman Higginbotham, former lessee of the property. During the past four years the mine has shipped upwards of $900,000 worth of lead-silver ore to the Bunker Hill smelter at Kellogg.

▶ The annual meeting of the Idaho Mining Association was held in Boise during the month. Prominent mine operators from all over the State attended. The opinion prevailed that output of strategic metals in Idaho would greatly increase during the coming months as more men became available for the mines. J. B. Haffner, manager of Bunker Hill and Sullivan, reported to the meeting that "the labor situation has eased considerably and we intend to better the present production marks during the winter, if possible." Furlough of soldiers to the mines was cited as being of much help in meeting the manpower situation.

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MINING EQUIPMENT

STOODY SELF-HARDENING is no ordinary welding rod—it is a high chromium—manganese—carbon—iron alloy possessing unusual wear resistant properties and used in relatively small amounts to protect surfaces of steel equipment against abrasion.

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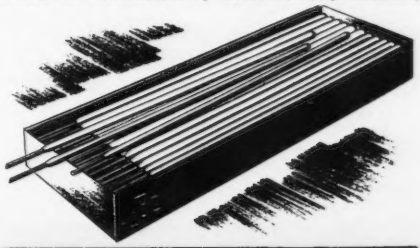

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FOR WASHING MINERAL ORES

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We also build the Eagle Screw Washer which can be equipped with paddles for light duty washing jobs. Many of these machines are operating in the mining industry today.

We also build the Eagle Screw Washer with a flare tub so that fines may be retained in tub instead of being washed away in the overflow.

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ALASKA

Gold Production Off in Past Year

Some gold mines permitted to resume—U. S. Smelting closes down placer operations for duration — Johnston re-elected president of Miners' Association

▶ Preliminary estimates by the U. S. Geological Survey indicate that the mines of Alaska produced in 1942 minerals valued at $19,306,000, of which nearly $2,300,000 was the value of the platinum metals produced and of the silver, lead, tungsten, mercury, chromium, tin, copper, and antimony, the rest being the value of the gold production. The value of the war-essential metals has not been itemized, for purposes of security. Of the total gold produced, about 28 percent is from lode mines. The reduction in the mineral output was due to a loss of manpower caused by war demands and the difficulty of securing equipment. On the other hand, the building of roads and airfields in the territory is expected to more than restore the mineral output of the territory after the war.

▶ Treadwell Yukon Corp. is expected to pay a 5 percent liquidating dividend of $100,000 when it passes out of existence early this year. Bunker Hill & Sullivan Mining Co., at Kellogg, Idaho, owns about three-quarters of the Treadwell stock. The company has mining interests in Alaska, Yukon, and Nevada.

▶ John Packie and Carl Erickson have been sinking a shaft on their Canyon Creek property, a tributary of Quartz Creek, in the Klondike. They are drifting into the frozen muck, using a hoist and a hopper to convey the gold to a convenient reservoir. They hit the pay streak in August. They were in Dawson in December securing supplies.

▶ Art Glover, in charge of the Fairbanks department of the Mines Assay Office, closed the office in December, but expects to reopen them this month. The local strategic mineral purchasing depot of Metals Reserve Co. has been closed for the winter but is expected to reopen when the assay office opens. These offices were in operation six weeks, during which Glover says $7,600 was paid to producers.

▶ War Production Board has announced that several gold mines in the Territory will be permitted to operate for at least a limited time to remove ore blocked out and to refill stopes with waste. No hard-rock miners, however, may be employed, and only elderly men can be used. Congressman Anthony J. Dimond urged that placer operations by old-timers should be permitted to continue.

▶ All Alaska placer operations of United States Smelting, Refining & Mining Co. have been closed indefinitely. Roy B. Earling, vice-president and general manager of the company, has gone to Boston to confer with the heads of the corporation. During his absence, R. J. Ogburn, of the engineering staff, is in charge.

▶ Men of the U. S. Bureau of Mines who have been investigating antimony veins concluded their work in December in the Kantishma region and returned to Fairbanks. The party, headed by Dr. Chris Pedersen, included eleven persons. The antimony property will be mined in the spring by Earl Pilgrim.

UTAH

Mine Labor Situation Is Easier

Potash Company of America to develop well in eastern Utah—Development active at Cuprite mine—Tintic Standard options Cougar Spar properties

▶ War conditions and difficulty in securing capital for the development of new properties continue to retard the tempo of Utah mining. Activity is mainly confined to the large properties with well-defined ore deposits.

▶ Operators report to A. G. Mackenzie, executive secretary of the Utah Metal Mining Association that the labor situation is less acute. A slight tapering off in new construction plus the furloughing of soldiers for employment in mines has helped to remedy the shortage. Several hundred miners, however, still could find employment in Utah mines, reported Mr. Mackenzie.

▶ Potash Company of America officials have announced that an extensive exploration of deposits in eastern Utah will begin as soon as arrangements can be made for drilling. After a visit to the area, G. F. Coope, Carlsbad, N. M., president of the company, explained that exploration will begin of the oil, magnesium, and potash potentialities as indicated by the deep well of the Utah Magnesium Corp. The Potash Company of America will develop the well under contract, and, if results are favorable, will undertake production. The activity may result in the building of treatment facilities at the well and the expenditure of many thousands of dollars. Mr. Coope conferred in Salt Lake City with Fay L. Wright, of Los Angeles, general manager of Utah Magnesium; John Sandburg, of Sacramento, president; and A. S. Brown, chairman of the Utah Department of Publicity and Industrial Development. Offices for the Potash Company of America have been opened in Salt Lake City, and articles of incorporation filed.

▶ Intense activity centers around the Cuprite scheelite deposits, the Wah Wah mine, and the Cougar Spar properties. The U. S. Bureau of Mines with James M. Marsh, engineer in charge, is doing development and exploration work.

▶ In addition, at the Cuprie property the Desert Silver, Inc., of Nivloc, Nev., in cooperation with the Metals Reserve Company, is investigating the possibilities of constructing a mill. An option has been taken by the Tintic Stand-

ard Mining Co. on the Cougar Spar fluorspar deposits.

▶Richard A. Wagstaff, metallurgist for the American Smelting & Refining Company, was recently elected president of the Utah Chapter, American Institute of Mining and Metallurgical Engineers; Adolph Soderberg, Utah Copper Company engineer, was chosen as the company's vice-chairman; and J. A. Marsh became secretary.

MONTANA

Development Pushed in Stillwater Complex

High-grade graphite in Ruby Mountain district—New Talc mine near Dillon—New zinc reduction capacity in operation

▶The RFL Graphite Co. is proceeding with the development of the Crystal Graphite mine in the Ruby Mountain district, 15 miles southeast of Dillon, in Beaverhead County. Approximately 100 tons of graphite are reported ready for shipment. This graphite was obtained from near-surface mining operations. A new adit crosscut designed to cut the graphite orebody some 400 ft. or more below the surface cropping is now in better than 700 ft. Seams of graphite have been cut by the last few feet of the adit. The next step in the development program will be a 200-ft. raise to connect to an old caved shaft in the orebody. This raise will provide needed ventilation in addition to prospecting the graphite, which is the sought-after crystalline variety and is said to be comparable to the best grades of imported Ceylon graphite. It occurs in seams, pockets, and small lenticular bodies in Pre-Cambrian metamorphic rocks, principally schist and gneiss. Mining operations to date have been confined essentially to high-grading the better seams and lenses at or near the surface. A considerable tonnage of low-grade material is left behind that may eventually be milled for its graphite content. There have been sporadic attempts by other operators in past years to work the property, but competition with imported graphite made profitable operation of the property difficult. Production from former operations is said to total some $75,000 in value. The operation is managed by Wayne L. Fenner, Whitehall, Montana.

▶The Anaconda Copper Mining Co., operating in the chromite deposits of the Stillwater complex under a management agreement with the Defense Plant Corp. has temporarily suspended development work on the Gish chromite property. The Stillwater Complex is an elongated body of ultra-basic igneous rocks in which the chromite occurs as an almost continuous band some 20 miles long. The width, grade, and other characteristics of the chromite band vary considerably from place to place. Early in 1942 Anaconda established a camp in the vicinity and proceeded with the exploration of the chromite deposits in the Gish property. At least two long adits

Ross is READY

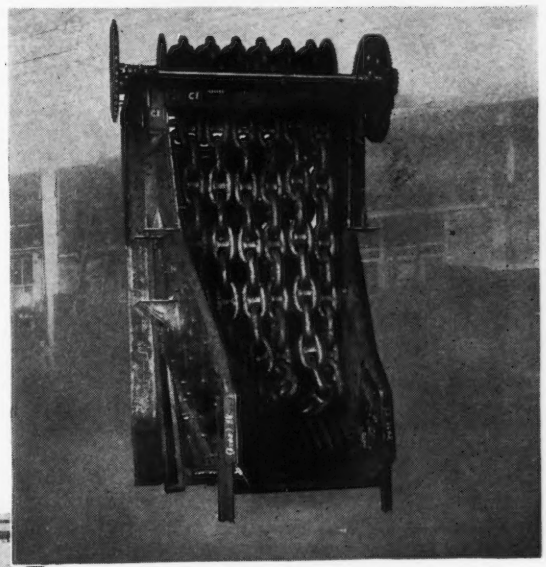
Now on the job to help handle **MORE MILLIONS** *of tons*

with

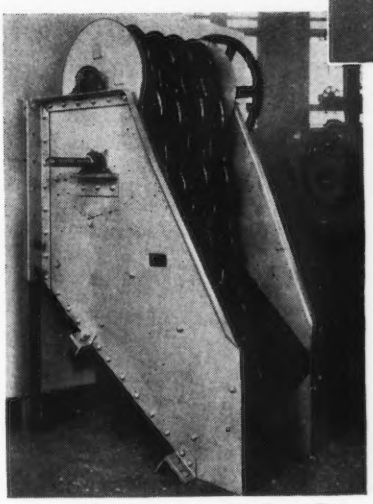
"FLOW CONTROL"

that means efficient and economical

ORE HANDLING



Ross Feeder No. 7 to feed R.O.M. Ore to Belt Conveyor



Ross Feeder No. 3 with Ross Bar Grizzly to feed 10"x20" Jaw Crusher.

The staggering ore tonnage demanded by the Army & Navy Munitions Board in 1943—nearly 500,000,000 tons—puts a premium on efficient handling and control equipment.

The Ross Feeder consists of a curtain of heavy endless chains, driven by an overhead tumbler and suspended to lie on the material and to travel with it.

The Ross Feeder has proved its efficiency in handling the heaviest rock and ore feeds to primary crushers, bin storage feeds to secondary crushers, hopper, bin and chute control feeds to conveyors and elevators.

In combination with a Ross Bar Grizzly, built in to the chute, it improves primary crushing operation and increases total tonnage. Its exclusive yielding top-control principle of operation ensures remarkably long life of equipment and the minimum of power use.

The Ross Feeder is patented in all the principal countries of the world.

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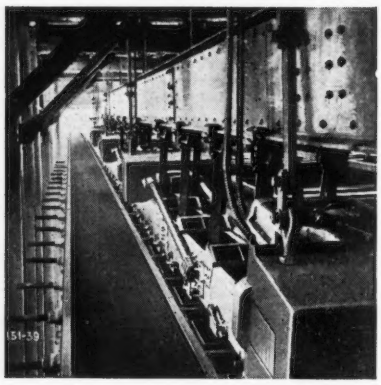
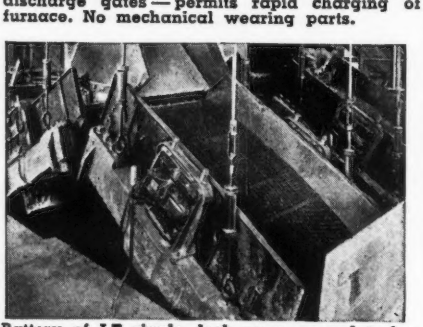
LOW-COST MATERIAL HANDLING

Jeffrey - Traylor electric vibrating grizzly feeder 24" wide — 48" long. 7 widths — 6 lengths. Handles 3 ft. cubes to dust.

Jeffrey-Traylor grizzly feeder discharging 250 tons per hour to picking belt conveyor. Separation at 3" and fines are by-passed crusher. Also open or totally enclosed pan feeders.



Jeffrey-Traylor reverberatory charging vibrating conveyor equipped with 22 Quick-acting discharge gates — permits rapid charging of furnace. No mechanical wearing parts.



Battery of J-T single deck screens used to by-pass fines in conjunction with crushers and rolls.

Jeffrey-Traylor (patented) units provide low cost handling — positive control over tonnage — use balanced high frequency vibration under absolute control. Send for Catalog No. 650.

The Jeffrey Manufacturing Co.

974-99 North Fourth Street,
Columbus, Ohio

▶MONTANA

were driven to the east on the chromite band from the valley of the Boulder River. Raises were put though connecting the adits. Some exploration by diamond drilling was carried on. Anaconda is pushing development work and mill construction on the Mouat chromite property. The Mouat mill, of 3,000 tons' daily capacity, is expected to be in operation by spring. The Benbow chromite property at the eastern end of the Stillwater complex, also operated by Anaconda, has been in production for several months.

▶Guy Ossello and Fred Masola, of Butte, are opening a deposit of manganese oxide ore in the Great Republic claim in the Butte district and are producing ore from the Great Republic as well as the Fredonia. Ossello and Masola started work on the Fredonia claim in 1941 and have shipped consistently from this claim to the Metals Reserve Co.'s manganese ore stockpile in Butte. Most of the ore from the Fredonia claim is coming from small open cuts in the vein outcrop. An 80-ft. shaft on the Great Republic claim has been cleaned out and manganese ore is mined through this shaft. Where necessary the ore is hand-sorted to grade. It consists essentially of psilomelane and pyrolusite. Seven men are employed between the two operations. Production is 100 to 150 tons of high-grade manganese ore per month.

The Tristate Mineral Company is conducting a new talc-mining operation twelve miles southeast of Dillon in Beaverhead County. The talc is mined from surface open cuts in the deposit. An adit crosscut is being driven into the mountain side to develop the deposit at depth. Underground mining via this adit will be undertaken when the talc that can be economically mined by open pit methods is exhausted. The talc is hauled by truck to the railroad at Dillon and shipped by rail from Dillon to Ogden, Utah. The Tristate Mineral Company has offices at Ogden, Utah and Dillon, Montana. N. J. Ambrose is in charge of the Dillon operations.

▶Mrs. W. S. Gage, of Twin Bridges, Mont., is reopening the Emma mine, in the Rochester district of Madison County, about one mile southwest of the old mining town of Rochester. A $5,000 federal loan has been obtained to be used in unwatering and sampling the mine. The collar of the 400-ft. Emma shaft has been repaired and a new headframe erected. An electric generating unit and electric pumps for unwatering the mine are being installed. From 1905 to 1932 the Emma was a producer of lead-silver ore, with the greatest production occurring in the years 1928 to 1932. During this latter period of operation the property was equipped with a 60-ton flotation and table concentration mill.

▶The $1,000,000 expansion of the Anaconda electrolytic zinc plant is now completed and in operation, affording a substantial increase in production of high-grade metal. About 100 additional men have been employed.

COLORADO

Partial Relief Granted Golden Cycle Shippers

Fire destroys Western Fluorspar Co. mill —Upper Clear Creek district is reviving— Golden Cycle conversion proceeding

▶William R. Gulliford, B. L. Dollard and George Sullivan all of Crested Butte are opening the Keystone zinc-lead property, with Gulliford in charge of operations.

▶The upper Clear Creek district, is again active. In early days there was no market for the zinc ores, which were left in the stopes or used for filling old workings after the rich veins of silver were mined out. At present these workings are being investigated by engineers of the U. S. Bureau of Mines. E. W. Ames, of the Bureau, has been busy laying rails at the Phillips property. A compressor house is being built at the portal of the Burleigh tunnel and an electrically driven compressor is being installed. When this work is completed, it is reported that a crosscut will be driven from a point 1,500 ft. east of the intersection of the Burleigh tunnel with the Phillips lode, north to cut the Dives-Pelican vein system between 200 and 300 ft. deeper than the present workings.

▶About 90 days ago, E. L. Laycock, of Denver, started rehabilitation work at the main Bull Domingo shaft of the Bull Domingo Mines Syndicate property. The caved shaft, extending from the surface to the solid granite, has been reclaimed and retimbered. Dewatering is being carried on during the retimbering work, and it is believed that by Feb. 15, the Bull Domingo will be producing zinc and lead ores, from the extensive underground deposits of this type of ore.

▶The Mickey Breen mine, at Ouray, is under development work by E. W. Creel. By the time that the new mill is erected at Ouray Mr. Creel should be producing some fifty tons per day, of zinc-lead ore that will have a combined content of these metals of 10 to 12 percent.

▶The Silver Spruce mill at Idaho Springs is being changed over to selective flotation, and the Utze Lode Co. is reported to be nearing completion of this work.

▶A 24x125-ft., 40-ton cyanide mill has been completed on the Whale property, near Idaho Springs, by A. H. Price. This mill is equipped with modern machinery and a gravity system.

▶The Colorado Sunrise mine, with values in zinc, copper, and lead, is being connected with electric power, and will be under steady operation throughout the winter by Ralph B. Wright and associates from Ouray. Considerable equipment is on the ground, ready to be installed.

▶Frank Kennicott, supervising operations at the Highland Mary mine, near Durango, has closed the property for

the winter, due to lack of water and heavy snows. This property will be opened when spring breaks and the snow can be cleared away.

▶Milling operations of the Western Fluorspar Co., at Walden, have been halted because of fire, which destroyed its mill proper, the change room, shops, and other buildings. M. P. Cloonan, mill superintendent, stated that company officials dynamited an area around the powder house and saved that structure.

▶Temporary houses, of row-type construction and containing from one to three bedrooms each, are being erected in fourteen communities. Colorado has the following as its portion: Leadville, serving the Climax Molybdenum Co., 210; Rifle, serving U. S. Vanadium Co., 44. Uravan, serving U. S. Vanadium Co., 50. Action in providing these dwellings for mine and smelter workers was taken as a result of joint agreement by the War Manpower Commission, the War Production Board, and NHA.

▶H. R. Henning, leasing the Defender claim at Silver Cliff has completed the unwatering, and is now breaking high silver-lead ore, which he will start shipping next month.

▶Fire of undetermined origin recently destroyed the shafthouse of the Fortune mine, above Sumptown, and also the gallows frame. Part of the timbering in the shaft was destroyed, one of the mine cables, ruined, and the two cages were dropped to the bottom of the shaft. Paul R. Clark, in charge of operations, will have the damage repaired this month and will be shipping crude zinc ores to the mill in March.

▶The United Gold Mines' Portland shaft has been timbered from the 3,000 level to the 3,254 level, and skips are being operated from the collar of the shaft to the Carlton tunnel level. The shaft, a three-compartment one, accommodates two skips and a manway, and is 7x16 ft. The 8-ft. pillar left just below the 3,000-ft. level as a protection to the working men has been removed. Ore will now be raised up the shaft instead of through the portal. The laterals from the Carlton tunnel to the Cresson and Vindicator properties will be completed after the war.

▶The work of unwatering the Mendota shaft has been hampered by the caving of the north wall on the fourth level below the Victoria tunnel level. As soon as this bad piece of ground has been caught up, work will be resumed on taking the water out to the fifth level, where some fine veins of zinc-lead ore have been exposed.

▶The Golden Cycle mill is being rapidly converted for the treatment of base metals. Max Bowen, mill superintendent, states that the bins are almost completed for receiving custom ores, and Parks B. Van Dolah is acting as zinc purchasing agent. According to present plans, the mill will purchase the zinc ores, and make settlement with the producers on receipt of the ores.

▶Merrill E. Shoup, president of the Golden Cycle Corp. has notified his former shippers that every Cripple Creek

INCREASE PRODUCTION OF VITAL WAR METALS

So there may be no repetition of the comment "too little and too late".

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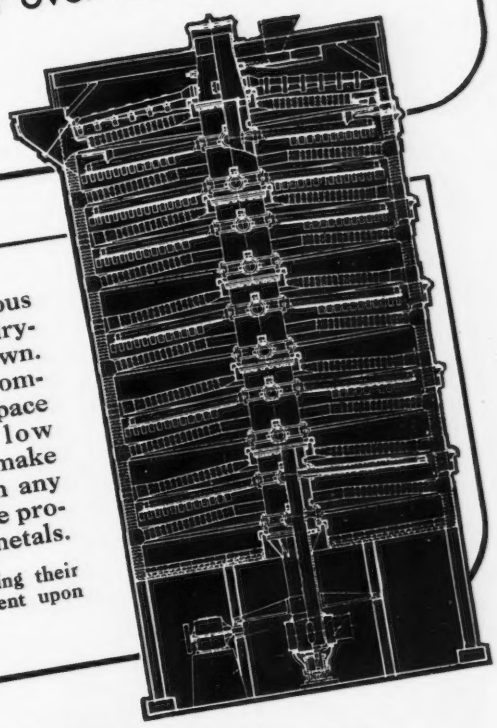
NICHOLS HERRESHOFF MULTIPLE HEARTH FURNACES have been treating strategic ores and concentrates for over fifty years—

Including: iron, tungsten, mercury, molybdenum and other ores and concentrates.



Their adaptabilty to various roasting, calcining and drying problems is well-known. Flexibility of design, compactness, small floor space requirements and low power consumption make their use a necessity in any program to increase the production of vital war metals.

Bulletin 206 briefly outlining their use and design will be sent upon request.

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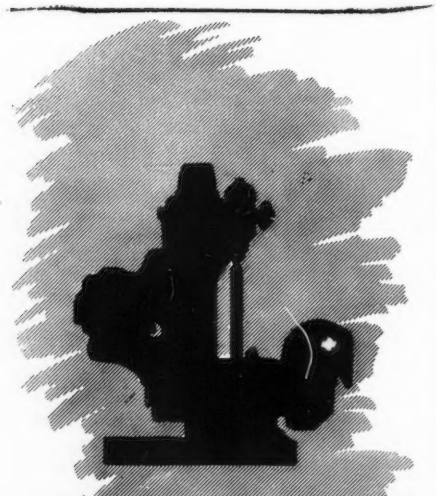

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▶COLORADO

and Boulder County, gold mine that shipped ore to the Golden Cycle mill at Colorado Springs in September, 1942, can ship a similar amount to the mill each month for six months.

WASHINGTON

Survey Will Drill Metaline District

Metaline Company reports improved labor supply — Eisenhower congratulates Howe Sound mine—Leonard re-elected president of Northwestern Mining Association

▶ Private enterprise which has developed three good producing mines and dividend payers in the northeast corner of this state is having its work supplemented by the U. S. Geological Survey, which has started a search for additional ore-bodies in the same locality. The Survey has made a thorough investigation of the ore deposits in the Metaline district and has followed up by issuing a contract for diamond drilling to Jesse L. Havlik, of Spokane. Before undertaking such operations on new ground, however, the contractor will drill an unexplored area of Metaline Mining & Leasing holdings west of the Pend Oreille River, and also on ground owned by Pend Oreille Mines & Metals Co., east of the river. He will employ two shifts at each operation.

▶ R. S. Handy, metallurgist with the Bunker Hill company at Kellogg, Idaho, is in charge of the metallurgical work at the Kaaba-Texas mine, at Oroville, in Okanogan County, where the values are chiefly in lead and zinc, with some other metals. The mine has been reopened to a depth of 400 ft., mine openings have been enlarged, and bunkers rebuilt.

▶ James W. Turner, of Spokane, manager, reports that Pateros Mining Co. has ceased operations until six months after the war. The property is five miles up the Methow River, in Okanogan County.

▶ A test of the new redistillation unit installed by the U. S. Bureau of Mines at the magnesium pilot plant at Pullman, after a 48-hour run, has been pronounced satisfactory, although it disclosed that several minor adjustments were needed to increase efficiency. This unit has been built into the pilot plant after a discovery that its capacity was not sufficient to care for the output of the first unit.

▶ The four-mile railroad spur from the Great Northern, at Marble, in Stevens County, to dolomite quarries, has been completed. It will bring this raw material to the magnesium plant being built in western Washington. Machinery for the quarry is being hauled in and the entire quarry investment is expected to be $500,000 or more. It is being built for the Defense Plant Corp. by the Electrometallurgical Co., a subsidiary of Union Carbide & Carbon Co.

▶ D. I. Hayes, manager of Metaline Mining & Leasing Co., in the Metaline district, reports the labor situation much improved since the coming of cold weather. He says men have come in from outside defense construction jobs, and that he has a normal crew now of about 160 men which he still would like to increase to get out additional ore. The Grandview mine, also under Mr. Hayes' management, has opened a new orebody carrying 9 percent zinc and 4 percent lead.

▶ Howe Sound Co., at Holden, has received a telegram of congratulations for the company and the men on the copper they are turning out for the war effort. The message was from General Dwight Eisenhower, commanding allied divisions in North Africa. The company's production also includes lead and zinc. Fifty or more army men obtained furloughs and went to work in this mine, enabling the company to hold up its production.

▶ James L. Leonard, Spokane mining engineer, has been re-elected president of Northwest Mining Association, and J. B. Haffner, manager of the Bunker Hill & Sullivan Co., at Kellogg, Idaho, re-elected vice-president.

▶ Dr. R. W. Moulton, of the chemistry department of the University of Washington says a pilot plant will probably be built at the university to test a new process of extracting manganese dioxide from low-grade manganese ore found on the Olympic Peninsula.

ARIZONA

Extensive Low-Grade Copper Deposits Discovered

Mardun Company has dry process pilot plant—Governor suggests merging mine bureaus—United Lead-Zinc has new orebody

▶ In his message to the Legislature on Jan. 11, Governor Osborne recommended merging the State Department of Mineral Resources with the State Bureau of Mines at Tucson in the interests of economy and efficiency. The Governor stated that such a move would "give the small mine operators of the State real service rather than lip service" and that he would prefer to have the change accomplished by legislation rather than by exercise of his appointive powers.

▶ According to J. S. Coupal, director of the Arizona Department of Mineral Resources, discovery has been made that a large area containing low-grade copper deposits in sandstone exists in the Painted Desert in the northeastern part of the State, and extending into Utah and New Mexico. Development has been undertaken by the Mardun Co. which has erected a 75-ton pilot mill north of Cameron. The process used concentrates the copper minerals as dust, which develops from dry crushing. The average grade of the sandstone bed being worked is said to be 7/10 of 1 percent copper. The concentrate carries 15 percent. The Mardun Co. is reported to have applied

to the RFC for funds to erect a 1000-ton mill.

▶According to J. H. Hoffman, general manager, United Lead-Zinc Mines, Inc., has broken into a good orebody of lead-zinc-gold-silver ore in the process of cleaning out and retimbering the Lead Carbonate tunnel. The property is in the northeast end of the Hualpai Mountains.

MICHIGAN

C & H Will Reopen Centennial Mine

Michigan said to contain vast dolomite reserve—Progress on Torch Lake tailings dredged—C & H employees receive Treasury award

▶At the annual meeting of the company in Boston on Jan. 26, the Calumet & Hecla management announced that the company is unwatering the Centennial mine with a view to its rehabilitation, provided suitable arrangements can be made with Metals Reserve Co. to purchase the production and that deliveries can be obtained on additional pumping equipment. It is estimated that it will take eight months to get the property into production. Output is expected to be 1,000 ore-tons per day. The company also announced the discovery of a new conglomerate orebody, the location of which was not disclosed.

▶According to Dr. R. A. Smith, State Geologist, Michigan, with two and a half billion tons, has the largest supply of high-grade dolomite ores in the nation and the basis for a vast new mining industry. The deposits are at the surface and accessible to water transportation. They extend in a 180-mile strip from the eastern end of Drummond Island to near Manistique, in the Upper Peninsula. Dr. Smith states that these ores yield 19 percent of their weight in metal, 1 to 3 percent higher than in other deposits.

▶At the new reclamation plant which is being constructed on the Quincy copper sands deposit at Mason, Torch Lake, the main building is housed in and work is progressing on the construction of the wooden hull for the dredge. Steel work for other plant buildings is well along and foundations have been poured preparatory to setting up the machinery. The work has been hampered somewhat by severe weather and priorities. Calumet & Hecla is building the plant, which will be operated by the Quincy company.

▶Brass billets are being successfully cast at the Calumet & Hecla smelter at Hubbell. Seamless tubing drawn from these billets is sawed into short lengths to be pressed into grooved recesses in high explosive shells. This causes the shell to grip the rifling of the gun barrel and to whirl rapidly. The rapid whirling holds the shell true to its course. In the old type of guns, copper was used, but with high velocity guns, such as used in this war, copper is reported to be too soft and may be torn off the shells.

Why Manganese Steel is Preferred for Ball Mill Liners . . . . . .

The more severe the service — the more definitely Amsco Manganese Steel justifies its selection. Its use in ball mill liners furnishes an interesting example.

These liners have to take continuous and brutal punishment; repeated impact shocks from the heavy steel balls, and scouring from severely abrasive ore. Liners of brittle metal, no matter how hard, often fracture after a brief period in service. While they last they resist abrasion, but they seldom have a chance to wear thin because of inadequate toughness.

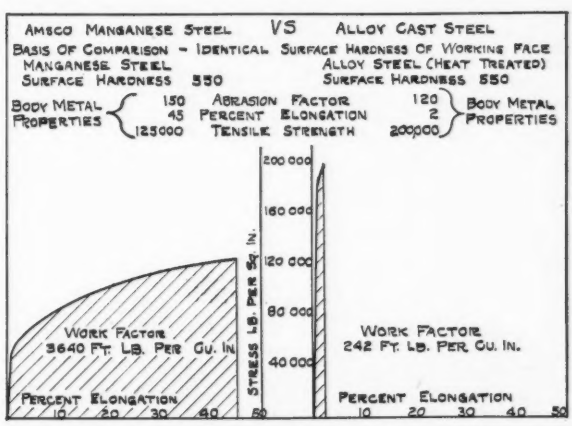
Standard manganese steel rates high in resistance to both the conditions which determine the life of ball mill lining: breakage and wear. When an Amsco liner goes into service, it is incomparably tough but not extremely hard; the surface hardness of a heat-treated casting being around 200 Brinell. But the work-hardening property of austenitic manganese steel is such that, under repeated impacts, it increases to as high as 550 Brinell. This work-hardness is self-renewing in continued service.

Breakage is dependent on strength and ductility, which in combination are the measure of toughness in a steel. Toughness, or the ability to deform without fracture, may be measured as a work factor, consisting of the number of foot pounds of energy required to break a structural member. Comparison shows a work factor for genuine manganese steel of over twice that of any other commercial alloy cast steel.

In abrasion resistance, austenitic manganese steel stands high among the metals employed for liners. Its best performance is given where both impact and abrasion are encountered.

Ball mill liners of manganese steel outlast those of other metals in most cases of severe grinding conditions, replacements are less frequent and fewer man-hours are wasted on maintenance. Increased output for the mills is made possible, since the liners can be made thinner than those of hard, brittle metals, providing a larger inside mill diameter. Reduction in weight also results in lower power consumption.

Bulletin 1141-L on ball mill liners will be mailed on request.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BASIS OF COMPARISON - IDENTICAL SURFACE HARDNESS OF WORKING FACE
MANGANESE STEEL
SURFACE HARDNESS 550
ALLOY STEEL (HEAT TREATED)
SURFACE HARDNESS 550
BODY METAL PROPERTIES
150 ABRASION FACTOR 120
45 PERCENT ELONGATION 2
125000 TENSILE STRENGTH 200000
BODY METAL PROPERTIES
STRESS LB. PER SQ. IN.
200 000
160 000
120 000
80 000
40 000
WORK FACTOR 3640 FT. LB. PER CU. IN.
PERCENT ELONGATION
10 20 30 40 50
WORK FACTOR 242 FT. LB. PER CU. IN.
PERCENT ELONGATION
10 20 30 40 50

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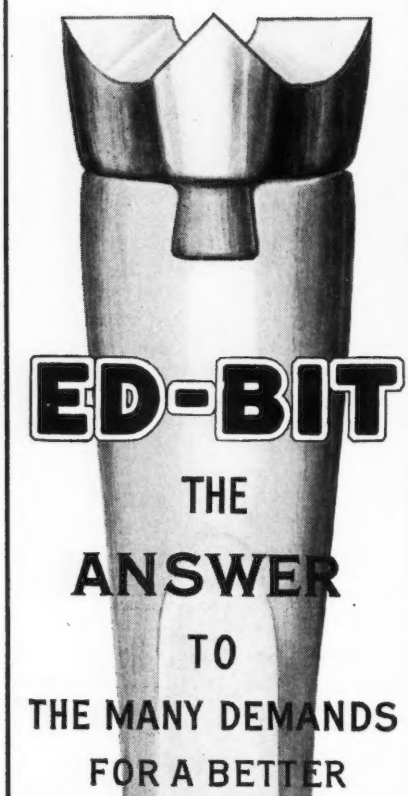

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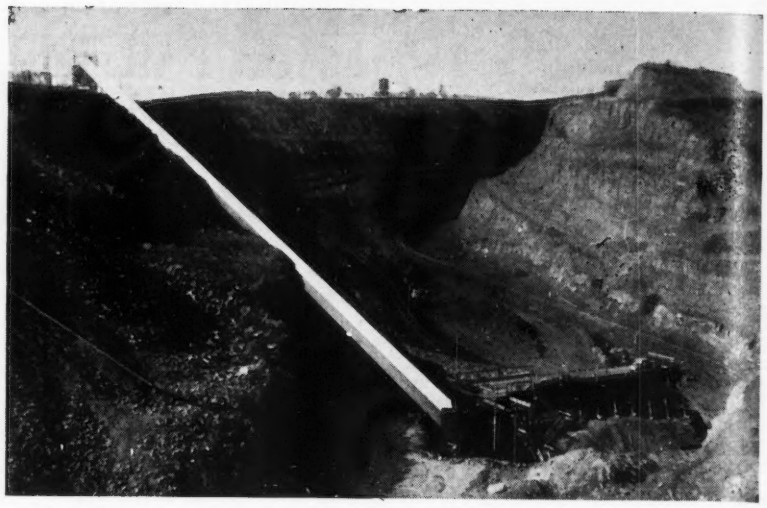

This 1,100-ft. conveyor at the Morris mine, Mesabi Range, uses a rubber belt with a wire carcass

IRON COUNTRY

New Process to Dehydrate and Briquet Soft Ores

Minnesota winter activities on grand scale —Fire breaks out in Athens mine—Mather mine bottoms shaft

▶ Winter activities in Minnesota are now being carried out on a scale commensurate with the rate of ore production during the 1942 shipping season. All operating companies are stripping overburden at all of the active properties and also at developments projects that are expected to produce this coming spring. Most of these stripping programs are being carried out on a 24-hour basis six and seven days a week.

▶ The Republic Steel Corp. has reopened its offices in the Sellwood Bldg., in Duluth. This office will be the district office for all the northern iron ore operations. F. H. Cash, general superintendent, will move his offices from Hibbing and take up headquarters in Duluth. Thomas Boundy, works accountant, and E. W. R. Butcher, chief engineer, will move their offices from Ironwood to Duluth.

▶ Butler Bros. has recently exercised its option on the lease of the Sullivan mine, at Virginia. This property was formerly operated by the Oliver Iron Mining Co., and has been inactive since 1915.

▶ A patent for the conversion of soft, porous, and partly hydrated iron ores into dehydrated, hard, dense ores for open-hearth furnaces has been applied for by R. H. B. Jones, of the geological department of the Oliver Iron Mining Co., Duluth. This new process does not involve any cementing material that might be harmful to the charge of the open-hearth furnace. Mr. Jones says that his process corresponds to Nature's processes in converting various ores to hard ores. A process such as this will greatly benefit the steel industry, as the supply of hard ore for open-hearth practice is limited. The more lump and hard ore available will necessarily lessen the amount of scrap iron necessary for this type of steel making. Open-hearth practice calls for approximately the same amounts of scrap iron and pig iron.

▶ On Jan. 3 a fire of undetermined origin was discovered on a sublevel above the seventh level of the Athens mine, of the Cleveland-Cliffs company, on the Marquette Range. The mine was closed for a week because of the danger from smoke and toxic gases and to permit the construction of brattices to seal off the fire area. At first it was thought that it would be necessary to build water-tight bulkheads and flood the fire area, but the sealing proved adequate to permit resumption of work in the greater part of the mine. During the sealing operation full precautions were taken to protect the workmen engaged from hazardous exposure. Production work was resumed on Jan. 12.

▶ A fire several weeks old in the Spies-Virgil mine of Cleveland-Cliffs, on the Menominee Range, took on new life when a cave-in on the sixth level permitted renewed access of air, and caused a shutdown of several days' duration. In this mine the problem was complicated by the sulphurous fumes given off by the ore in contact with the fire. New concrete brattices were constructed to seal off the fire area again, and the management believes that the fire will be smothered in due course.

▶ Shaft-sinking operations at the new Mather mine, on the Marquette Range, which was two years old on Jan. 6, are now at 2,350 ft., which will be the bottom for the present. It was originally planned to sink to 2,900 ft. before drifting, but this objective will be delayed to facilitate early production. Ultimately, it is planned to sink to 4,000 ft. The first haulage level will be at 1,600 ft. and the second at 1,750 ft. Only a small production is expected in 1943, but a considerable tonnage is planned for 1944. When capacity is reached it is expected that the two 12-ton skips will be hoisting a million and three-quarters tons per year. The mine is owned by the Negaunee Mine Co. and operated by Cleveland-Cliffs.

ARKANSAS

Will Stop Buying Low-Grade Batesville Ore

Report new device for mercury distillation—Active search for quartz crystals—New bauxite reserves discovered

▶Quartz crystal mining may soon start in Arkansas, and the possible sites are in Montgomery and Garland counties, according to C. A. Simms, of the North American Quartz Crystal Company. This announcement was preceded by an inspection trip by WPB officials who were in search of quartz crystals for use in radio. The company office is in Hot Springs. A geological survey is being pushed on a 20-acre tract in Montgomery County leased from W. P. Fisher, of Silver, and John Lewis, of Crystal Springs. Because of indecision as to the type of machinery to be used, commercial operations are being held up. Negotiations are under way for an 80-acre tract in Garland County and another 100 acres in Montgomery County for possible sites of mines. The company mentioned has been designated by the WPB as purchasing agent for quartz crystals in Pulaski, Hot Springs, Garland, Perry, and Montgomery counties and is paying cash for suitable water-clear quartz crystals.

▶Mining of cinnabar is on the increase in the Clark-Pike county field. The Pike Mining Co. is preparing to mill ore at the Wall Mountain shaft. The Ozark Quicksilver Corp. has reopened the Mid-Continent mine.

▶A cheaper and more productive method of reducing mercury from cinnabar has been developed by R. E. Vandruff, an engineer and geologist from Glenwood, according to a WPB official who declines to be named. He stated that a laboratory retort had been built that increases the yield of mercury from cinnabar from 75 percent to 99 percent and would reduce the present reduction cost by half. A test plant is now under construction at Glenwood.

▶Roth Harrison, general manager of the Magnet Cove Barium Corp., at Magnet Cove, said that the fire which destroyed the company's drying room and warehouse caused a $19,000 loss and will result in a week's shutdown.

▶J. R. Thoenen, district engineer, Little Rock district, U. S. Bureau of Mines, has announced that 5,000,000 tons of new bauxite ore has been discovered near Sweet Home, Pulaski County. Ore will be shipped to the Hurricane Creek mill for processing.

▶The manganese ore-purchasing office of the Metals Reserve Corp., at Batesville, has been discontinued and its manager, A. H. Coleman, transferred to Las Vegas, Nev. All manganese ore purchased in the future will be through the American Zinc Co. of Arkansas. Only high-grade ore will be purchased after Feb. 28.

▶The Ark-Ozark Mining Co., headed by J. E. Sawhill, of Harrison, expects to have its new mill completed and in operation in February. The plant will

"TO THE FUTURE!"

YUBA DREDGES are favorably known and have been used throughout the world for many years. Long standing personal and business friendships were built up thereby, making every member of Yuba's organization keenly aware of the global nature of this war. They are personally interested because of their direct acquaintance with dredgemen in many of the countries affected. "Business as usual" is temporarily a thing of the past, for reasons which they also understand fully, and which are results of enemy action and domestic economic rulings.

"What to do about it?" The answer is simple. Everything possible to win the war and to do it quickly! That is the Yuba spirit and intent. After the war, again there will be new Yuba dredges, designed and built by a company having access to widely varying, actual field experience. We send greetings and best wishes to Yuba friends wherever they may be, with the sincere hope that, in the not too distant future, every placer dredge again will be swinging and digging as usual, to the sounds of ringing metal, groaning bucket lines and splashing water which are music to the dredgeman.

When the time comes again, Yuba dredges and parts will be of the same high standard as in the past, but also designed to do the jobs of the future. Many dredging areas will have to be re-appraised and new plans made to mine them economically and profitably. Let Yuba help in the design of your future dredge or in rebuilding and re-equipping your present one.

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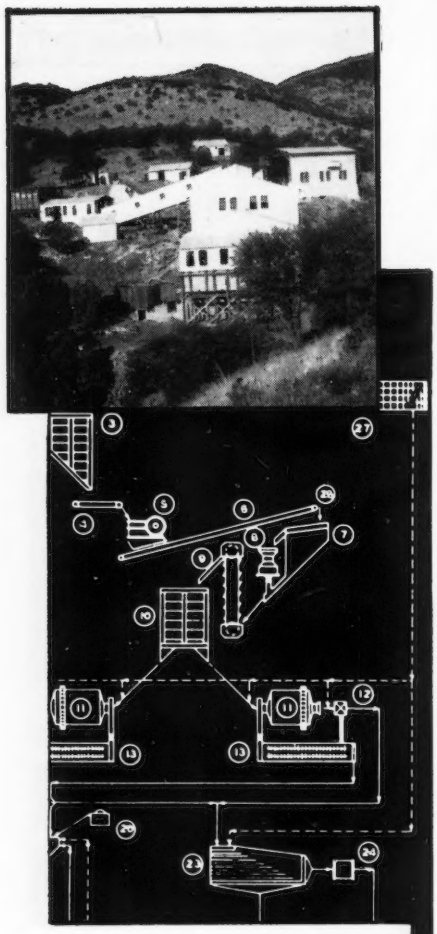

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ARKANSAS

have a capacity of 75 tons a day. The company's properties lie on Huzzah Creek, northeast of Bellefonte, in Boone County, and consist of 380 acres.

▶ Production of high grade in the Batesville field has practically stopped because of the phos limitation in Metals Reserve specifications. High-grade ore cannot be produced in the field with the penalty imposed.

▶ The Ozark Mining & Milling Co., operating the St. Johns mine, on Cave Creek, is moving its power shovel and some other equipment into the bauxite area near Little Rock, and will operate on bauxite ore. W. L. Dorsey, of Batesville, is in charge of operations.

▶ The Hurricane Mining Co., of Harrison, has started clean-up operations on the Hurricane mine, near Pindall, in Searcy County. The company's greatest handicap at this time is getting equipment. The biggest job will be clearing out or cutting through a big deposit of gravel and dirt, which was washed into the open pit mine years ago by a storm. During the first World War this was the biggest producer in the field.

SOUTH DAKOTA

Fire Destroys Large Spodumene Mill

School of Mines working on tin flotation to improve Bolivan production—Homestake pleads for ore tax reduction

▶ A method to increase the production of tin in Bolivia, the United States' chief wartime source of the important metal, is being studied by the South Dakota School of Mines here. Research work on a new flotation treatment, which would recover tin which now goes over the dump as waste, is being financed by Neil A. O'Donnell, general manager of the Minera Unificada del Cerro Potosi, second largest tin producer in Bolivia, according to Professor Bancroft Gore, head of the department of metallurgy at the School of Mines. Tin milling is now done by jigging and tabling, a gravity process which loses as much as 40 percent of the tin in the ore in the form of slimes which are not recovered.

▶ Reconstruction of the spodumene mill of the Black Hills Tin Co., at Tinton, which was recently destroyed by fire, will be undertaken as soon as possible, Earl Schultz, superintendent of the mine, has announced. The mill and $75,000 worth of new machinery burned on Jan. 5. Total loss was estimated by company officials at $500,000. The fire was started by an explosion in the drier room and rapidly swept through the entire building. Many improvements have been added during the last eight years and the mine was fast becoming one of the outstanding spodumene sources in the United States. The company had recently installed $75,000 worth of new government-financed machinery which was to have been placed in operation on Jan. 6, the day after the fire.

▶ A reduction in the South Dakota ore tax from 6 percent gross to 2 percent gross has been asked of the South Dakota Legislature, which is now in session, by the Homestake Gold Mining Co., which is now limited as to operations by WPA orders and expects to cease gold production activities entirely on July 8. The company contends that the present 6 percent tax rate is unparalleled in the mining laws of any State and that in normal times tends to prevent capital from being put to work in South Dakota. The ore tax, it is contended, is unsound because it compels the company to leave large quantities of ores in the ground.

TRI-STATE

Eagle-Picher Reopening Bird Dog Mill

Kansas Ex shaft at Oronogo down 175 ft. —Merge Western and Captain tailings operations — Romo company resumes at Lincolnville

▶ With demand far exceeding supplies, the predicament of the Tri-State zinc concentrate market by the middle of January was as unpredictable as the weather. However, the latter featured sub-zero temperatures—the lowest in ten years—which cut the declining production rate further.

▶ Reconditioning of the old Commerce Bird Dog mill—one of the largest and the first central concentration plant in the district—has been started by the Eagle-Picher Mining & Smelting Co., preparatory to the resumption of milling operations in the near future, according to G. C. Niday, of Miami, Tri-State manager for the company. With a capacity of 100 tons of ore an hour, large plant will be utilized to treat certain ores from Galena and Oronogo and to eliminate some congested truck routes or long cross-hauls. A standard-gage railroad track will be laid from an N. E. O. ore-loading spur, a half-mile southeast of the mill, to make connections for railroad transportation of the Galena, Oronogo, and possibly other ores, Niday said. A narrow-gage railroad formerly was used to haul ore from nearby mines to the mill. At Galena, during the last year, the company has reopened several old shafts and sunk two or three new ones, northwest of the town. Northeast of Galena the company has an unloading ramp and railroad spur for the movement of ore produced by the Galena Mining Co. on the old Southside tract. Some ore from the bottom of the Oronogo Mutual Mining Co.'s open-pit mine at Oronogo, which, because of its muddy, soapy character was not suitable for treatment at the Central mill, is now being trucked to Eagle-Picher's Navy Bean mill, at Wentworth, but will be shifted to the Bird Dog property. Work of repairing the mill was started at the close of 1942. The plant is expected to be ready for operation by the last of this month or the first part of next. The Bird Dog mill started operation in 1929. In addition to being the first central mill in the Tri-State, the modern plant fea-

tured the first underground receiving hoppers and primary crushing units.

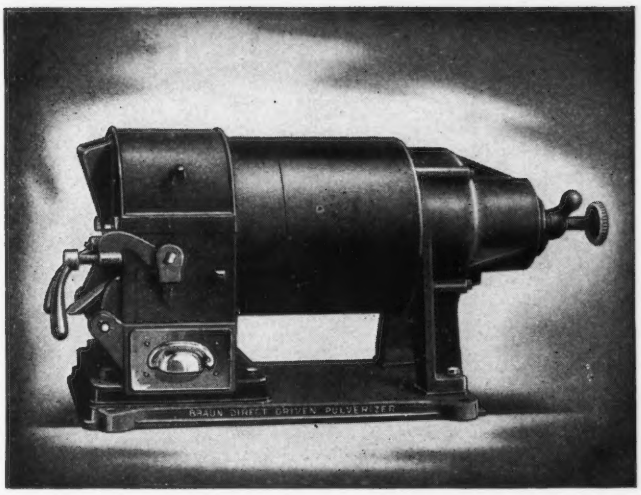
▶A new shaft being sunk by the Kansas Explorations, Inc., on the Buckingham land, a mile north of Oronogo, has been put down to a depth of 175 ft., Ross Blake, of Joplin, company district manager, announces. Considerable water was encountered in approaching this level, and the progress of sinking operations has been slowed accordingly, Blake said. The company is handling the water with a 12-in. Peerless pump, powered by electric motor, which was installed some time ago in a drill hole just south of the shaft. An electric hoist was installed in the sinking derrick over the shaft, and a 400-cu.ft. Sullivan compressor, powered by an electric motor, was installed in a building structure near by to provide air for sinking operations. The company has done considerable churn drilling in the area of the shaft, having blocked a sizable orebody in recent years. When the development work is completed and the mine is opened up at a lower level, ore will be trucked to the company's Snapp mill, which is situated about a mile and a half to the northwest. Sinking and pumping operations were delayed several months because of inability to obtain electric power under present procedures.

▶Milling operations have been resumed by the Romo Mining Co. at its mill near Lincolnville. The company is treating custom ore from the Craig Mining Co.'s development northwest of the Lincolnville schoolhouse. The Craig company has reopened the old Common-Law mine, and is carrying on operations on the 80-ft. level. A derrick and hopper has been built over the shaft, and ore is trucked to the Romo mill. Air for underground mining operations is obtained from the Romo compressor plant.

▶Western Mining & Milling Co. and the Captain Milling Co. have been merged as the Westcap Mining Co., according to H. H. Hartzell, of Baxter Springs, general manager for the new company, who was in charge of operations for the former companies. Two large tailing plants—the Western, formerly the old Commerce Anna Beaver, northwest of Cardin, and the Captain, west of Treece—are being operated by the company.

▶The following officers of the Tri-State section, A.I.M.E., were elected at a meeting in January of the new directorate: Victor C. Allen, Joplin, chairman; G. E. Abernathy, Pittsburg, vice chairman; James K. Richardson, Miami, secretary-treasurer. Other directors, previously elected for 1943, were Howard H. Utley and I. V. Korts, Baxter Springs; S. S. Clarke, Miami; George M. Fowler and W. F. Netzeband, Joplin.

▶Sam Ashe, of Baxter Springs, former secretary and general superintendent of the Rialto Mining Corp. for many years, has accepted a position as general superintendent for F. W. Evans mines, according to an announcement by F. W. (Mike) Evans, head of the latter company. Ashe will assist Evans in expanding his mining and milling operations in the Missouri-Kansas and Oklahoma sections of the district. A successor to Ashe at the Rialto properties has not been announced.



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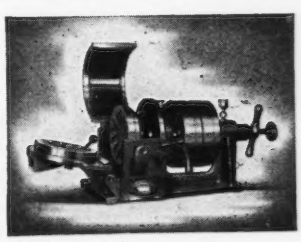

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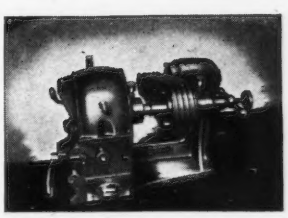

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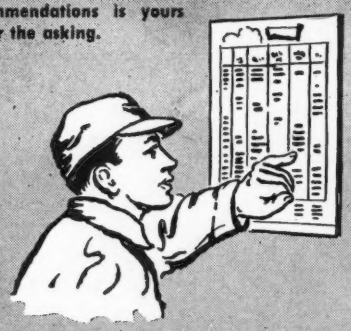

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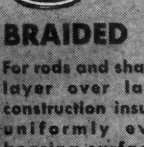

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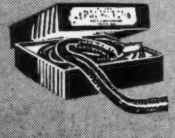

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CANADA

Strike Stops Montreal Copper Refinery

Scheelite discovered by Upper Canada—B. C. Chamber of Mines has successful meeting—Western copper mine labor supply improved

▶ An illegal three-day strike came to an end Jan. 8 after tying up about a third of the copper output of the Dominion. Demands were made by 220 men employed at the Montreal plant of Canadian Copper Refiners for a wage scale similar to that in use at Sudbury. A hearing on grievances is to be called by the Department of Labor.

QUEBEC

▶ Redmond Quain, president of Senator-Rouyn, has announced completion of deepening the shaft to 1,430 ft. and preparation for a program of development below the 1,000-ft. horizon. Plans are also being made for exploratory work on surface with a diamond drill to check results of a recent geophysical survey by Dr. A. Brant. Indications of possible gold-bearing structure were found about 1,000 ft. south of the main mine workings. This, as well as a second area to the northeast near the Noranda boundary, will be tested by a series of shallow drill holes.

▶ Normetal Mining Corp. is engaged in opening a block of new levels 150 ft. apart below the 2,000 and shaft sinking is being completed to a depth of 2,750 ft. From the 975 level down to 1,385 ft. copper content of the ore was found to increase from 1.79 to 3.91 percent and at a point 300 ft. deeper the copper grade had further improved to 4.4 percent. Latest reports in January were of opening the ore zone at 2,150 ft., the first of the new levels, and a crosscut on the 2,600 level was approaching the ore. The program in progress will have important bearing on the mine's future.

▶ Development work at East Malartic Mines was cut more than half in the third quarter compared with the first three months of 1942, according to a report by the general managers, Futterer and Reid. Owing to the labor shortage, mill feed was down to 1,141 in September from 1,230 tons daily at the first of 1942, but mining ore of higher grade had more than made up for the smaller tonnage treated. Reserves are being maintained by developing ore located 1,600 ft. east of the shaft on the 2d, 4th and 10th levels. Normal mine development has been stopped until such time as adequate manpower is available. Fraser D. Reid, H. C. McCloskey, and W. C. Cochrane, representing Howey Gold Mines, have been elected to East Malartic's board to replace J. P. Norrie, who resigned as vice president, and Charles O. Stee and W. G. Worden. Previously the resignation of Joseph R. Norrie as mine manager had been announced.

▶ E. V. Neelands, consulting engineer of Canadian Malartic Gold Mines, states that operating costs have advanced 22¢ to $2.64 in the last two quarters, while recovery per ton has declined to $3.88. In the first nine months gold output averaged $4.04 a ton, compared with $4.37 in the same period a year ago.

▶ Wartime Metals Corp. has contracted with the Northern Canada Power Co. for the supply of power to the former property of Molybdenite Reduction Co., in LaCorne Township. A Siscoe Gold Mines subsidiary, Siscoe Metals, has developed the molybdenite property under an agreement with the government agency, and production is expected to start soon. In the meantime, mill construction is being rushed in Preissac Township, on the important molybdenite property of Dome Mines northeast of the Mic-Mac mine, and production at the rate of 500 tons a day is scheduled for this spring.

ONTARIO

▶ The Kamiscotia copper property of Hollinger Consolidated, located west of the Porcupine camp, is preparing to go into production and has signed a contract for 2,000 hp. to be delivered by the Northern Canada Power Co. Work is under the direction of John Knox, Jr., former manager of Francoeur Gold Mines.

▶ Dome Mines reports 1942 production at $6,579,536, which was $1,189,832 lower than the year before. Grade was also down, with an average of $11.96, against $12.38 per ton, and mill feed was reduced 168,000 tons to 627,700 tons in 1942.

▶ A promising showing of scheelite was intersected early in January on the 375 level of Upper Canada Mines when an exploratory drift was being run out into unexplored ground in the west part of the property. Tungsten content up to 2 percent has been reported from samples cut along a 3-ft. vein exposed for a 20-ft. length in the drift. Tests are being made to determine the possibilities for concentrating the scheelite from this discovery, the most promising to date at Upper Canada. As work advances into the west area, the tonnage possibilities are being extended to the point where they may outclass the orebodies developed in the main mine workings. Ore widths are from 12 to 16 ft. in the first two shrinkage stopes to be opened. A new shaft has been put down to tap the west zone and is connected with the main shaft by a long drive. It will be about two years before the west area gets into full production.

▶ Another official report on the difficulties of gold production in recent months has been issued by Moneta Porcupine Mines. From March 31 to Dec. 31 the mill handled 42,201 tons, compared with 45,560 in the same period the year before, while net profits fell from $347,681 to $235,983.

BRITISH COLUMBIA

▶ The 30th annual meeting of the British Columbia Chamber of Mines, held on Jan. 12, 1943, was the best attended and most enthusiastic in years. The guest speaker of the evening was the Hon. E. C. Carson, Minister of Mines. Officers elected for 1943 include: Honorable

President, the Hon. E. C. Carson; Honorable Vice-Presidents, Mayor J. W. Cornett of Vancouver, and Dr. R. E. McKechnie, chancellor of the University of British Columbia; Honorable Treasurer, Frank P. Archibald; president, A. E. Jukes; vice presidents, Dr. Victor Dolmage and Dr. Harry V. Warren; and a committee of 15 as follows: U. S. Annett, Charles E. Anstie, Dr. W. B. Burnett, Colin J. Campbell, C. M. Campbell, S. J. Crocker, G. S. Eldridge, H. McN. Fraser, W. E. Gilbert, H. L. Hill, A. D. MacGillivray, G. M. Morris, Ned. E. Nelson, Ross Thompson and A. M. Whiteside. Gomer P. Jones, immediate past president, Alfred C. Garde, of the Omineca branch, and H. N. Freeman, of the Vancouver Island branch, are also members of the executive committee. The Chamber is urging a moratorium on assessment work on gold claims, better treatment of gold mining, and more encouragement to prospectors and business initiative.

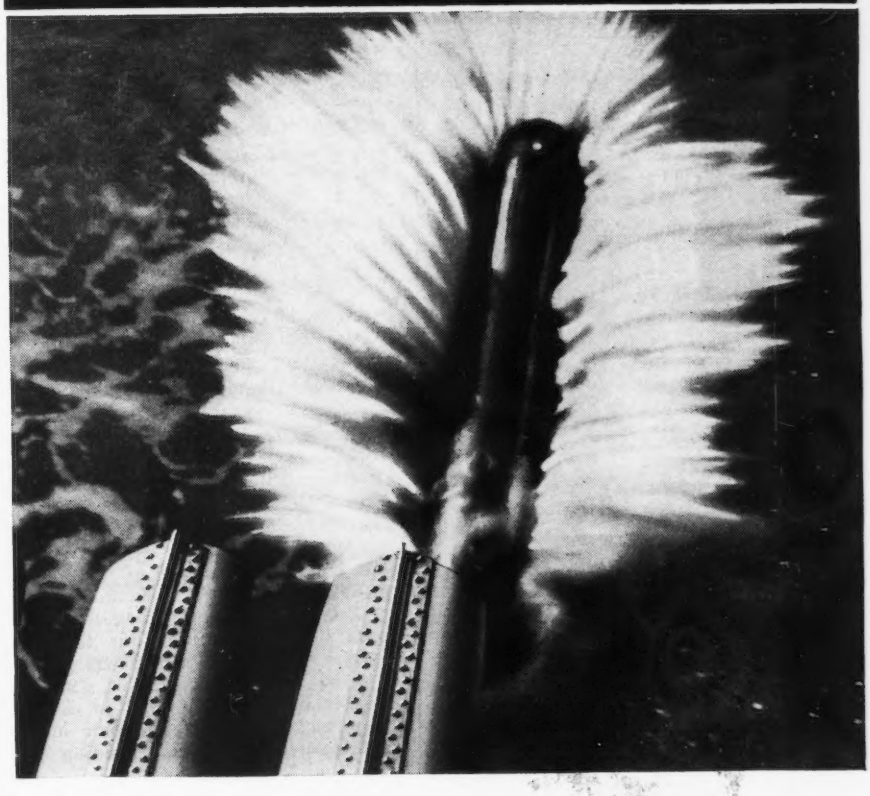
▶The supply of underground labor at the two major copper-mining operations in the province is increasing, with a consequent expansion in production. During the past summer the shortage was very acute, with Britannia working at barely 40 percent of capacity. Recent figures released by C. M. Campbell, safety engineer of the Mining Association of British Columbia, indicate that Britannia had a crew within 19 percent of normal and Granby within 5 percent of normal at the year end. However, some of the new labor has come from the prairie provinces, and there is fear that this will be required on the farms in the spring.

▶In the fiscal year ending Oct. 31, 1942, Bayonne Consolidated Mines, Ltd., former Nelson district gold producer, showed a gross operating profit of $39,297; net loss for the year was $7,135 after provision of $29,432 for depreciation and $17,000 for depletion. During the period prior to Aug. 14, when the mill was closed, the value of production was $236,270 from 15,027 tons, averaging $15.72 per ton. The shortage of labor precluded the maintenance of development work in advance of stoping. Consequently no estimate is available as to ore reserves, but directors are of the opinion that several sections of the mine will prove of value when operations are resumed. An option has been taken on the "Blue Eyes" tungsten group, three miles from Rossland, for $85,500, and 500 ft. of exploratory tunnel will be driven without delay.

▶Shareholders of Ymir Yankee Girl Gold Mines, Ltd., have approved a distribution of 10¢ per share, to be paid partly as a dividend and partly as a return of capital, as soon as a ruling can be secured from Ottawa tax authorities regarding the amount of undistributed surplus. This disbusement will require $222,500. According to the company's annual report this will leave sufficient funds in the treasury to maintain in good order two placer properties in Yukon Territory, where development has been deferred until after the war.

▶Gold Frontier Mines, Ltd., Ontario gold producer, has incorporated a subsidiary, Recox Mountain Base Metals, Ltd., which has undertaken development of the Noble Five, Surprise, and Deadman lead-zinc properties in the Slocan

A "TIN FISH" TAKES TO WATER



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▶ CANADA

mining division. An extensive diamond-drilling contract has been let to Boyles Bros. Drilling Co., Ltd., the first holes being drilled on the 18th level of the Noble Five, a former producer, and one equipped with a 100-ton mill.

▶ Estimated smelter returns of Zincton Mines, Ltd., during the six-month period ended Nov. 30, 1942, were $238,906. This Sheep Creek subsidiary will benefit through the tariff reduction from 1.2¢ to 0.75¢ per pound on zinc imports into the United States.

▶ Anyox Metals, Ltd., subsidiary of Ventures, Ltd., is diamond drilling the Snowstorm group of copper claims in the Ashcroft mining division.

▶ December production of Cariboo Gold Quartz Mining Co., Ltd., was 2,159 oz. gold, value at $83,121, from 5,291 tons of ore milled. During the period ended Nov. 30, 1942, the first ten months of the current fiscal year, production was valued at $1,176,666 from 77,675 tons of ore treated. Exploration and development aggregated 5,224 ft. and diamond drilling, 4,549 ft. Operating profit has been steadily declining due to the unsatisfactory labor condition. It was $94,780 in the first quarter, $20,647 in the second, and only $8.07 in the third. However, there has been some improvement noted since the rescinding of the National Selective Service's Order 19, and at the same time there has been an improvement in the grade of ore.

▶ During the last quarter of 1942, Bralorne Mines, Ltd., produced 20,656 oz. gold, valued at $772,156, from 35,149 tons, averaging 0.57 oz. gold per ton. Although the labor shortage compelled a reduction of 25 percent from normal mining and milling operations, there has been no depletion in broken-ore reserves, leaving the mine in excellent condition to increase tonnage as quickly as the crew can be enlarged. United States government regulations have forced the closing of the subsidiary, Summit King Mines, Ltd., in Nevada. Both mine and plant and being maintained in condition to permit of a resumption of operation when the time is more auspicious. The company has been searching for a strategic-mineral property and has also advised the Metals Reserve Co. that it is willing to accept a non-profit managerial contract to operate an essential mine.

▶ Recent mine development at the Privateer mine, has been encouraging, a new strike having been made on the old Privateer 1,000-level and the Prident stopes being in excellent shape for increased output.

YUKON TERRITORY

▶ The Dominion Bureau of Statistics estimates mineral production in Yukon Territory at $3,301,414 for 1942. This is subdivided as follows: strategic minerals, $840; base metals, $46,698; gold, $3,043,733; and silver, $210,143. A plentiful supply of moisture during the past season presages favorable ground conditions for 1943 operations.

MEXICO

Miners Union Demands 25 Percent Raise

Congress passes bill to make tuberculosis compensable—New manganese deposit at El Alamo—Report mercury discovery in Zacatecas

▶ Labor trouble that has been rather chronic in the Mexican mining industry but which for some time had been less acute, flared up again with the advent of winter. This manifestation is the strike the national miners union tentatively set for Jan. 29, but which was postponed for 30 days at the request of President Camacho. Observers believe that the government will be able to prevent a strike by persuading the workers to accept a 10 percent increase. If a strike is called it will affect the operations of 67 companies.

▶ Cia. Minera de Santa Maria de la Paz, S.A., Matehuala, San Luis Potosi, has overcome the grave problem of a lack of sufficient railroad cars to move its ore, a shortage that threatened suspension of the company's work. The National Railways has provided enough cars for this purpose and given assurance that the company will be well served, in that regard. The National has purchased the entire El Oro Mining and Railway Company, operating over the 10 km. between the mining centers of El Oro and Tultenango, State of Mexico, which some time ago suspended service because it was unprofitable. The National is operating this railroad on a trial basis for a month. If this operation proves to be unprofitable, the company intends to abandon the service completely. Mining and business interests along the route have petitioned the National, which is owned by the Mexican government, to continue operating El Oro, saying that suspension of this service would cause them a heavy loss, as it is the only worthwhile transportation facility in their region.

▶ Congress and the Senate have approved the bill sponsored by Congressman J. Buenventura Lara, providing that the federal labor law should class tuberculosis as an occupational disease and that its sufferers should enjoy the full compensation and other benefits the law allows for this category.

▶ In announcing that it has investigated and found true the reported discovery of a large manganese deposit at El Alamo, near Chihuahua City, the National Commission for Stimulation of the Mining Industry said that a Mexican company, name not given, is being organized in Mexico City for development.

▶ Mining work is on the increase in the Pachuca sector, Hidalgo, because of the war demand for many metals and minerals that the region produces, including silver, according to the Ministry of National Economy. Cia. Minera de Real del Monte y Pachuca is leading in this work and has resumed operations on several properties, particularly in the Zimapan, Actopan, and Tulancingo regions.

▶The National Commission for Stimulation of the Mining Industry has opened another of the chain of small treatment plants it is establishing in key mining zones for the benefit of small-scale operators. The new plant is at Santa Ines Yatsechi, near Ocotlan, Oaxaca, and is of 100-ton daily capacity. Installation was made by Manuel Montaño and Francisco Gonzalez Treviño, commission engineers.

▶Inspectors of the National Commission for Stimulation of the Mining Industry are investigating reports by prospectors that they discovered a mercury deposit, claimed to be 2.5 km. long by 80 meters wide near Majoma, Zacatecas, close to San Luis Potosi and 70 km. by automobile from Catorce, the famed San Luis Potosi mining center.

▶The El Tepehuaje mine, San Jose de Gracia, Sinaloa, a good gold producer in its day, that was abandoned several years ago, has been given to its former employees and several prospectors of the region by the state and federal governments, to work cooperatively.

▶Change of its name to the Cia. Minera Porfirio Diaz, S.A.—for General Porifiro Diaz, who was President of Mexico for 30 years, 1880 to 1910—is announced by the Cia. Minera Plomo y Plata, S.A., one of the oldest operators in the Pachuca, Hidalgo, sector.

▶The federal Attorney General is continuing to campaign against ore thieves. Thefts have caused mining companies considerable losses. Five men, whom police say were company watchmen, are in jail at Guanajuato City accused of raiding properties of the Cia. Minera de El Cubo, S.A., mineral de El Cubo, Guanajuato, and stealing three tons of high-grade ore and tools worth $100.

CHILE

Copper Production Breaks Record

Three new copper mining operations projected—Conversion of two gold mills to copper treatment completed—New copper blast furnace near completion

▶Available figures prove that during 1942 Chile has broken all previous records in copper output. The three American-owned porphyry coppers continue production at full capacity of the installed mine, mill, and plant machinery. Chilean-owned copper properties are also doing their utmost to increase copper production in spite of a severe shortage of mining and milling machinery of all kinds as well as of mine supplies, which must all come from the United States. A new company has been formed to exploit the Cerro Negro copper mine 40 km. from the town of Cabildo on the Longitudinal Railroad, Province of Aconcagua. The mine is about 240 km. northwest of Santiago. According to report, 500,000 tons of 3.3 percent copper ores have been proved by sinking shallow vertical shafts to the underlying mineralized porphry. The mine will be ex-

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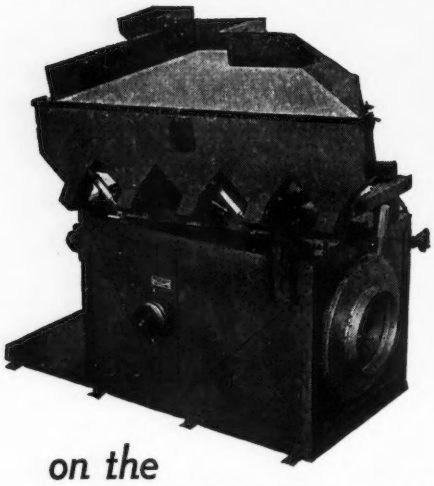

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Three Lions

Roasting tin concentrate at the Colquiri mine, Bolivia, to remove volatile impurities

▶CHILE

ploited by open-cast and underground systems of mining, depending on the thickness of the overburden. The project calls for the construction of a primary crushing plant at the mine; a 3 km.-long aerial tramway; a 400-ton per day flotation mill, and the necessary camps for employees and workers. Also, a considerable mileage of new roads will have to be built. Power will be purchased from the Compañia Chilena de Electricidad, which, in spite of its name, is an American-owned corporation, and will be transmitted from the Chagres substation at 44,000 volts to the mill site. The carrying out of this project, which, taking into consideration the financial capacity of local capital, can be considered as a large undertaking, has been made possible by the purchasing within this country of idle machinery of American construction for mine and mill and of the old Lebu tramway. A part of the transformers and certain small items of milling machinery will have to be imported from the States, but it is hoped that the necessary priorities will be secured.

▶ Almost opposite de Cerro Negro mine, the Compagnie Miniere Du M'Zaita has been developing for the last few years the Cerrado copper mine. This is now ready for exploitation, and Du M'Zaita will start next March to expand here the capacity old Caracoles mill, which for more than 20 years has been milling 120 tons of 3.5 percent copper ore per day. The Caracoles mine is now exhausted. The concentrates from both mines will be smelted in the neighboring Chagres smelter. A new road will be built for this purpose. The fact that both mines are only a few kilometers apart will allow the necessary power to be transmitted over the same line, which will permit a considerable saving in transmission lines and transformers. In this way, 450 tons of new blister copper per month will be available from Chile for war purposes, without the United States having to supply the capital or most o the machinery necessary for these new enterprises. The capital for the Cerro Negro enterprise has been furnished by the well-known Punitaqui Mining Co and the Corporación de Fomento. Engineers Eulogio Sánchez E. and J. L Claro are respectively president and general manager of the new enterprise Fernando Benïtez is consulting engineer

▶ Another new copper company, the Carrizal Consolidated, has succeeded in joining under one controlling interest most of the mining claims in one of the most famous of the old copper mining camps of Chile; that of Carrizal. A new mill of 150 tons a day capacity has been built, utilizing second-hand rebuilt machinery. This enterprise, which is also Chilean-owned and financed by the Corporación de Fomento, proposes to increase the capacity of its mill to 400 tons per day as soon as possible by purchasing idle milling machinery. Power will be generated by diesel engines and the ore will be transported to the mill by the Carrizal-Cerro Blanco railroad, purchased some years ago by Caja de Crédito Minero. There are available in this camp 500,000 tons of 2.81 percent copper ore in the dumps alone.

▶ The El Salado and Punta del Cobre mills of Caja de Crédito Minero, which previously to the Pearl Harbor surprise attack were almost exclusively floating and cyaniding gold ores, have now been adjusted to mill copper ores in their flotation sections. El Salado mill is receiving ores from the Laura, Jote, and other neighboring mines. Caja de Crédita Minero has just signed a contract to mill all the copper ores from the Abundancia mine, in the Punta del Cobre mill. Combined flotation capacity of both mills is 500 tons per day. The cyaniding section of El Salado will continue treating gold ores.

▶ In March Caja de Crédito Minero will blow in a 50 ton per day blast furnace for producing copper matte at Carrizal. As there is an acute shortage of metallurgical coke in the country, charcoal will be used as fuel.

AUSTRALIA

Gold Production Still Declines

Hill 50, Eldorado Tennant Creek, Maude & Yellow Girl, and Blackwater gold mines have good year, despite considerable difficulty

WESTERN AUSTRALIA

▶One of the most successful of the State's smaller gold mines is the Hill 50 Gold mine, which is operating at Mount Magnet, some 500 miles northeast of Perth. The company is working a series of lenticular auriferous bodies in greenstone, associated with jasper, and the mines of the field offer a notable instance of persistence of gold in depth in the jasper formations. As a rule, payability is limited to depths of 100 ft. or so. Operations at Mt. Magnet have, so far, established a limit of payability approaching 600 ft. in depth, but operations in the Hill 50 mine are still above the 400-ft. horizon. The company is working six lenses, and, in the financial year just closed, earned a net profit of £A63, 264. Ore milled amounted to 42,566 long tons which yielded 13,467 oz. of gold, which realized £A131,743. The average recovery was 6.32 dwt. per ton. Development work carried out was less than usual, owing to shortage of labor, for which reason it was not possible to continue the sinking of the main shaft and open up No. 4, or 400-ft., level, or to develop material tonnage of new ore. Though several new lenses of ore were intersected, their values at the points of intersection were low. Ore reserves were estimated at 193,754 tons of proved ore assaying 6.07 dwt. per ton and 60,731 tons of probable ore worth 5.07 dwt. per ton, or a total of 254,485 tons assaying 5.83 dwt. per ton. Costs were 9s. 4.5d. less than in the previous year, due largely to the operation of the new mill and to a lesser extent to the reduction in development work necessitated by the shortage of manpower.

In the previous year mining and treatment costs were 34s. 8d., development 6s. 7d., and administration and depreciation 4s. 5d. per ton, making a total of 45s. 8d. per ton. Ore is mined by sublevel stoping and treatment follows conventional practice of fine-grinding in ball mills, straking, thickening, agitation, and filtering on rotary filters. Recent additions to the mill include a closed circuit grinding section which has greatly improved the mill work, and the capacity of the plant is now 3,800 long tons of ore per month.

NORTHERN TERRITORY

▶Eldorado Tennant Creek, Ltd., is the leading mine in the Northern Territory, which includes Central Australia. The mine is the principal producer on the Tennant Creek gold field, and in the financial year recently closed, it earned a net profit of £A21,003. The orebodies

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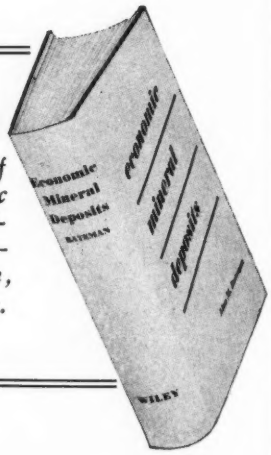

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▶AUSTRALIA

occur in close association with large masses of hematite occupying positions at intervals along extensive shear zones. Later movement along these shears has resulted in considerable fracturing of the containing rocks and also, to a lesser extent, of the ironstone masses themselves. Later, transverse shears have been developed, related to a granitic intrusion on one margin of the field. The gold, which accompanied the granite, has been deposited in shoots at the intersections of the two systems of shears, the shoots being in general pipe-like in form and of a horizontal section usually not exceeding 600 sq.ft. Gold deposition has been unaffected by the presence of the hematite. Values in the shoots may be as high as 10 oz. of gold per ton over appreciable tonnages of ore, and the general average of the field is nearly one ounce per ton. The Eldorado mine has now established the record for depth on the field, having opened up profitable ore at 300 ft. from surface. The gold is very fine, and the new mill on the Eldorado mine is designed for all-sliming and cyanidation. The hematite portion of the ore is very hard, but that portion consisting of schist replaced by iron oxide is usually much softer. As the oreshoots in the field may be rather widely spaced, exploration and development costs are high and the tonnage of ore proved is small in proportion to the expenditure. In the period, the mill treated 8,355 tons of ore, which gave a return of 11.84 dwt. of gold with 5.4 dwt. in the sands for future treatment. Costs for the year were 58s. 6d. per ton and ore reserves in the three shoots are estimated at 10,160 tons of 18.4 dwt. per ton-grade. There is also a substantial tonnage of lower grade ore not yet blocked out which can be included when the treatment plant is brought up to full capacity. The field is extensive, and as the unusual nature of the gold occurrence is better understood, it may become an important gold producer, particularly as accumulated evidence is steadily pointing to persistence in depth.

VICTORIA

▶One of the soundest gold mines in the State is the Maude and Yellow Girl Gold mine, at Glen Wills, in the mountainous northeast. A considerably faulted lode, of a width rarely exceeding 6 ft, has been opened up from a long adit, and from an internal shaft nearly 2,000 ft. from the entrance. Electric locomotive traction is used in the adit. Ore is crushed in a stamp battery having a capacity of 20,000 tons of ore per year, and after recovery of the free gold by amalgamation, the sands are fine ground in a ball mill and passed to the flotation section, where a pyritic concentrate containing the remainder of the gold is recovered for consignment to smelters in New South Wales. The lode has now been proved to the No. 9 level and ore reserves are estimated at 83,000 tons. The labor position is, of course, difficult, for though the mine has been allotted a full quota of men, the company is

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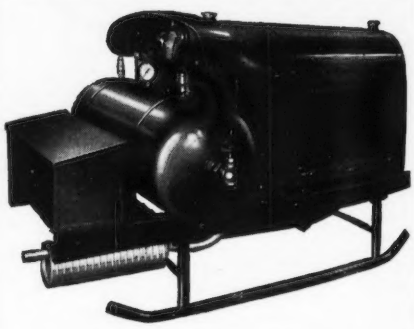

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powerless to retain them and government will make no provision in this direction, and it is very difficult to replace those who drift to other employment. Consequently, development has fallen by 60 percent. During the past year the mill treated 14,880 tons of ore for a recovery in bullion and concentrates of 5,471 oz. of gold. The nature of development is indicated by the fact that of 1,349 ft. completed during the year, 850 ft. was in payable ore. Working costs were:

	Per Ton
Mining and transport.....	22.4s.
Treatment	12.4s.
Development	7.0s.
Total working costs.....	41.8/s.

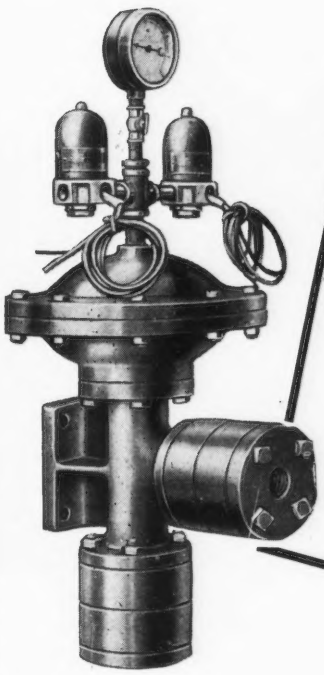
▶Deborah Gold mines, N.L., which has been amongst the leaders in the Bendigo field, incurred a small loss in the past financial year, due to the breakdown of the hoisting engine on the main shaft and to suspension of underground work during the intallation of a new plant. In the last six months, ore milled amounted to 3,236 tons, which returned 5.78 dwt. per ton, the production being half that of the previous period. Working costs, including development, were 94s. 8d. per ton. The main shaft is now 1,753 ft. deep and a level is being opened at 1,720 ft. Operations are now restricted to one shift per day, so that the company will do little more than mine sufficient ore to cover the cost of maintenance of the underground workings and carry out limited development.

New Zealand Mine Profits Despite Difficulties

BLACKWATER MINES, LTD., in New Zealand, is working a property in the Reefton district of the South Island. As is now universal in the gold mining industry, the past year was one of considerable difficulty for the company, which, nevertheless, made a net profit of £45,734. The main shaft was sunk a further distance of 130 ft. in the period and has now reached a depth of 2,633 ft., and No. 15 level is being opened out at a depth of 2,600 ft. from surface. The total development accomplished was 1,324 ft. of which 798 ft. was driving, which exposed 557 ft. of reef carrying an average value of 12.41 dwt. gold per ton over a mean width of 29 in. Fresh additions to reserves were made at Nos. 13 and 14 levels. At No. 15 level the reef was intersected in the crosscut from the shaft and was worth 16.3 dwt. over a width of 13 in. A total of 262 ft. has been driven, of which 239 ft. was on reef which had an average value of 13.27 dwt. gold per ton over a width of 23.5 in. Ore reserves were estimated at 92,308 tons assaying 9.95 dwt. per ton.

During the year ore treated amounted to 39,555 tons averaging 9.99 dwt. per ton, from which 18,750 oz. of gold were obtained, equivalent to a recovery of 94.88 percent. Total working costs, including development, were 40s. 10d. per ton. Apart from the difficulties arising from the labor position, output was seriously retarded by the refusal of the miners, over a period of three months, to work on contract.

SLURRY
Pumping at its Best



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NATIONWIDE SALES AND STOCKS

Washington Reflections

(*Continued from page* 122)

Mining Machinery

Given manpower and materials, present plant facilities are adequate to turn out at least 20 percent more mining machinery than is presently being fabricated. Within six months, the same plants could step up production more than 40 percent of the current pace. This was the consensus of the new 15-man Mining Manufacturers' Industry Advisory Committee at its first meeting with WPB mining equipment chief Arthur S. Knoizen in Washington in mid-January. Result is almost certain to be a WPB plan for putting mine machinery production on a definitely scheduled basis. Scheduling (a form of allocation) probably will be accompanied by a so-called limitation order establishing positive quotas.

Several lines of heavy industrial equipment already are under WPB scheduling and quotas, notably power equipment which went under scheduling last summer. Involved in such a program is WPB regulation of the quantity and kinds of equipment to be made, establishment of production schedules and control over deliveries. "Through such scheduling we hope to achieve maximum utilization of materials, facilities, and manpower," Mr. Knoizen told the committee, "and to make available more equipment to the highly essential coal, metal, and nonmetallic mining industry."

Some members of the committee fel that a scheduling program could b initiated at once, but others held tha it would be better to plan on abou April 1—beginning of the second quarter—to give WPB and the industry time to sort out existing orders and prepare plans. An order setting up the necessary machinery and outlining the procedure probably can be expected within a short time.

Mine operators were given another opportunity to express themselves on the problems confronting the industry when the new Metal Mining and Smelting and Non-Metallic Mining Conference Committee met to discuss priorities and equipment. One of the important things brought out in the meeting was that the mines are out of spare parts. No longer can an operator in need of a repair part go to the store room and find a new piece on the shelf. The new part must come from the manufacturers' stock or it must be made.

The danger of this situation to the prospects for uninterrupted production at full capacity have been recognized in the high priority ratings that have been given the machinery manufacturers to enable them to compete successfully for material against all comers. Now that the mining industry has "no fat to live on," nothing is being overlooked that will insure an adequate supply of repair parts and maintenance supplies.

Rumors that some of the mining machinery manufacturers now making ordnance items are to be reconverted to the manufacture of mining machinery seem to be without foundation. The excess manufacturing capacity announced by the machinery people should be ample to provide all the required new equipment and replacement parts for the coming year. As brought out in the meeting of the machinery manufacturers, it is merely a problem of getting the material. The recent granting of new priority ratings to mines and to mining machinery manufacturers has been done with the repair parts situation in mind.

Bismuth Under Full Control

EXPANDING military requirements have resulted in bismuth being put under complete allocation and inventory control. The indicated unrestricted requirements for the coming year are many times the available supply. The situation will be met as in all similar instances by a sharp curtailment of non-essential uses and then by bringing the millitary program into line with the supply. There is apparently little hope of improving

the supply during the coming year. The production of bismuth varies with the production of lead and other nonferrous metals, it being recovered as a byproduct. Apparently, the only opportunity to improve the supply is by importation.

Electrometallurgy

(*Continued from page* 108)

ently the mine in Nevada was insufficiently developed, and the concentration results were not satisfactory. The process involved calcining the concentrate in multiple-hearth roasters, briqueting it with coke and peat moss (from British Columbia) to promote diffusion of chlorine, and treating with chlorine in electrothermic retorts to fume off anhydrous magnesium chloride, electrolyzing the latter in Magnesium Elektron cells with cyclic recovery of chlorine from the cells. Late in October it was announced that Anaconda Copper Mining Co. had bought the 52½ percent interest of the Cleveland people in the company for $75,000 and had undertaken the management.

The Permanente Hansgirg-process plant is reported as having solved its major troubles. Natural gas shock-cooling is still being used.

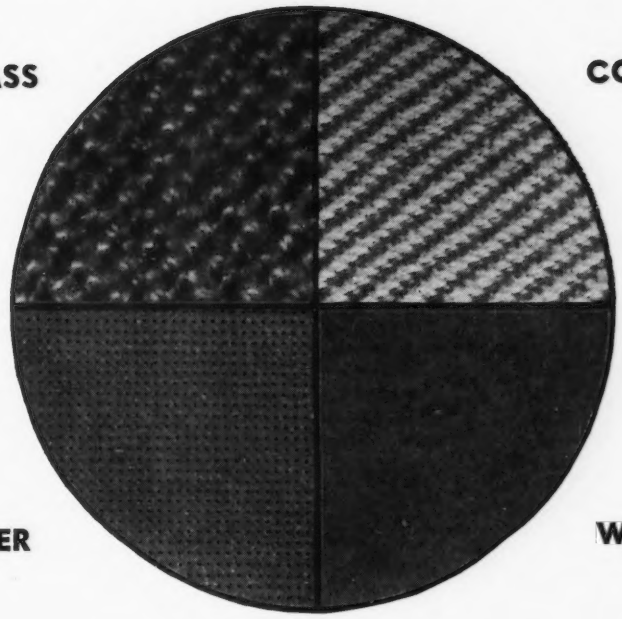
The Pidgeon process was recommended by the committee of the Academy of Sciences as offering the wartime advantages of simplicity, rapid plant construction, less electricity used or none at all, general geographic availability of the dolomite used, relative and pure magnesium produced. It is interesting to note that the Ford Motor Co. engineers had chosen a carbothermal reduction process with oil cooling as the most promising for the pilot plant. For the Ford Pidgeon process plant retorts 10 in. inside diameter, 22 ft. long with the center 13 ft. in the heating zone were decided upon after numerous trials.

NICKEL—International Nickel spent $35,000,000 to increase capacity 25,000 tons over that of 1940. Repairs to the Finnish nickel smelter at Kolosjoki were reported as being carried on. The plan is to handle 650 tons ore per day.

TIN—Large installations for electrolytic tin plating were built. A feature of note is the use of large copper oxide rectifiers to supply the low voltage d.c. for the plating. These rectifiers have a capacity of up to 5,000 amperes. Three electroplating lines were being built requiring 180,000 amperes of such rectifiers.

The Belgian Congo Geomines has enlarged its electrolytic tin smelting plant in Katanga to 10,000 tons metal per year. The product averages 99.95 percent tin.

FILTER MEDIA



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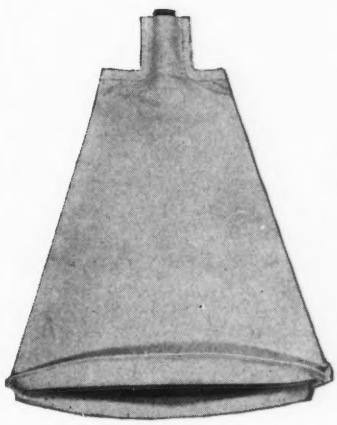

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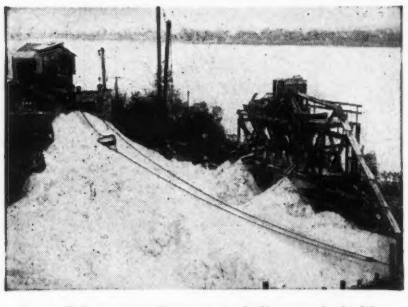
Above is a typical example of a Sauerman Scraper installation of large capacity with self-propelled tail tower as used at mines and processing plants for open storage of materials. This type of machine is able to cover a wide storage area and handle a large tonnage both storing and reclaiming.



A small Sauerman Scraper stockpiles crushed silica rock on an irregular ground space alongside a washery and reclaims this stored material as required to a drying plant.

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Tendremos mucho gusto en enviarle un catalogo en Espanol, describiendo las Locomotoras Davenport.

Australia

(*Continued from page* 92)

Wales has been affected less than in any other State, and the output for the first six months of the year, 41,509 oz., is slightly greater than that for the first half of 1941, when 41,062 oz. were produced.

VICTORIA—Gold mining in this State has suffered severely through manpower control. The gold yield to Aug. 31 was 75,166 oz., or 25,105 oz. less than for the corresponding period last year. Of this total for the first eight months of the year, the Bendigo field contributed 31,310 oz., whereas the production for the similar period of 1941 was 47,105 oz. At the end of 1939 there were 100 quartz mines operating in the State, either producing or in course of development, but the number is now reduced to 28, of which 10 are at Bendigo.

The outstanding mines in the State are North Deborah Gold Mines, N.L., Bendigo; Wattle Gully Gold Mines, N.L., Chewton; Morning Star (G.M.A.) Mines, N.L., Wood's Point; Maude and Yellow Girl Gold Mining Co., N.L., Glen Wills, and Victoria Gold Dredging Co., N.L., at Newstead. Throughout 1942, North Deborah mine maintained an output of 1,400 tons per month of ore worth 12 dwt. gold per ton, the production for the first 14 weeks of the current financial year being 5,132 tons of ore for 3,199 oz. of gold. Dividends total £A252,800, or £3 19s. per share.

Wattle Gully mines reports that it is now compelled to reduce labor from 140 to 25 men. The nature of the ground is such that it is imperative to keep the workings unwatered, or collapse would result, stopes being up to 50 ft. wide on a lode dipping at 45 deg. in heavy country. The ore maintains a consistent grade of 8 dwt. gold per ton, and until the effect of labor restrictions became serious, the mine had paid dividends of 6d. per month without interruption for several years. The Morning Star Co. hopes to maintain operations close to normal scale, as a community depends upon it. During the past financial year 16,458 tons of ore treated yielded 8,199 oz. of gold. The Maude and Yellow Girl mine also supports an isolated community and is working a much faulted lode with a high mineral content. An extensive development policy has been followed, so that dividend distributions, at £A17,625, are not a fair index of the mine's importance. Victoria Gold Dredging is the leading alluvial mine in the State and has paid £A462,500, or 37s. per share, in dividends. Output for 21 weeks of the current financial year was 1,050,000 cu.yd. dredged for a recovery of 7,183 oz. of gold.

The dredge of Harrietville (Tronoh),

Ltd., at Harrietville, is practically completed and operations will commence this year. It is the largest in Australia, being 300 ft. long, 72 ft. wide, and 12 ft. deep. It is equipped with 20-cu.ft. buckets, has a digging range of 130 ft. below water level, and a rated capacity of 350,000 cu.yd. per month.

SOUTH AUSTRALIA — This State has maintained an important output of manganese ore and contains the principal iron-ore deposits of the Broken Hill Proprietary Co. The production of non-metallic minerals is important and includes magnesite, graphite, barytes, gypsum, and salt.

QUEENSLAND—Mt. Morgan, Ltd., continued to make steady prograss in removal of overburden to expose the underlying copper-gold ore for extraction by open-cut mining, which will ultimately be carried to a depth of 700 ft. from surface. The batter of the open cut will be 50 deg. from the horizontal. Some of the overburden carries values sufficiently high for treatment, but the greater part is dumped. Ore from this source —that is, outside the calculated ore reserves—supplied 70 percent of the mill feed. Total overburden removed, in a series of four benches to a depth of 350 ft., was 1,780,064 tons compared with 1,364,887 tons in the previous year, the ratio of overburden to sulphide ore being 2.09 to 1. This will be maintained for twelve months, when a marked decrease will be practicable. Costs for the year were higher, due to increased overburden discarded as waste and increase in the basic wage and in cost of mine stores. Cost of mining and treating sulphide ore was 12s. 2.5d. per ton and that of oxide ore, 3s. 2.6d. per ton, compared with 10s. 11d. and 2s. 8d. respectively in the previous year. The net profit for the period was £A127,314, after providing for depreciation, air raid precautions, and gold tax.

At Mt. Isa Mines, Ltd., production of lead and of zinc concentrate has been maintained. Important development work has been carried out between Nos. 7 and 9 levels at the Black Star mine, where two roughly parallel chalcopyrite lenses, embracing upward of 500,000 tons of copper ore, occur. Production of copper is expected before long and a probable output of 5,000 tons per annum has been mentioned.

TASMANIA—An intensive search for strategic minerals has been carried out in the island, particularly into tin deposits in the east, northeast, and, on the west coast. Graphite of good quality has been located and bauxite and magnesite deposits have been examined.

(*Continued on page* 154)

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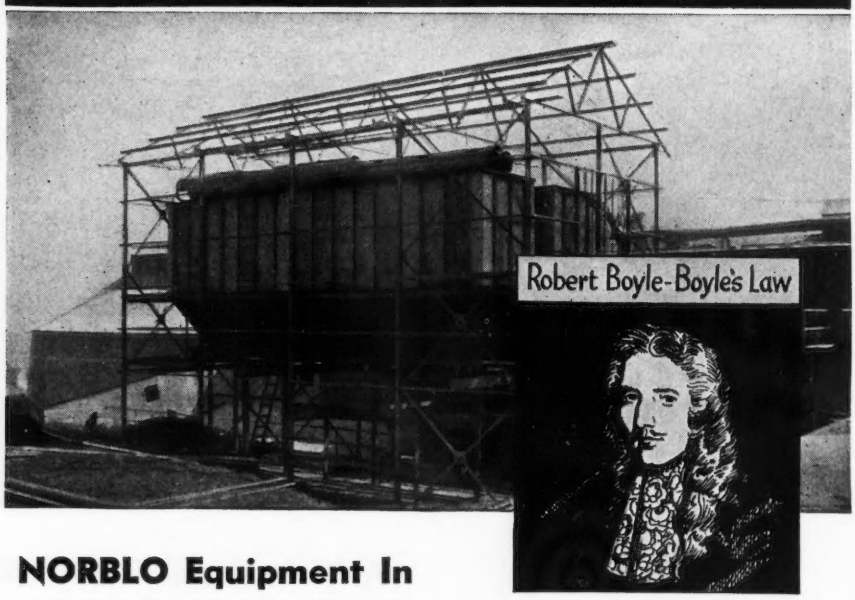
Nature makes the Rules for DUST COLLECTION



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DUST COLLECTION

THE NORTHERN BLOWER COMPANY

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Mt. Lyell continues the most important copper producer in the Commonwealth, but under war conditions little information is available.

Briseis Consolidated, N.L., has maintained its position as the leading tin mine, monthly outputs approximating 50 tons of tin oxide from the sluicing of some 60,000 cu.yd. of ground. Recent costs, including the removal of basalt overburden, were 20d. per cubic yard of stanniferous drift worked. The drift is 250 ft. thick and is capped by 150 ft. of basalt. Hydraulic water is under a head of 350 ft.

United States

(*Continued from page* 84)

Treasury. Production of newly mined domestic silver continued to come, as usual, from base-metal mines of the West. The Sunshine mine, in Idaho, was permitted to stay in operation because of the antimony also produced at its property.

Gold, which in former wars has been regarded as a necessary product, and is still so regarded in other belligerent producing countries, found itself relegated to a sufficiently poor status to have its producers denied serial numbers as essential producers. Later, on Oct. 9, gold mining was in effect characterized as the least important of all non-essential industries, as it was singled out as the sole victim of an order to cease operations by the War Production Board, so that those employed in it would be forced to find work in more essential industries. This action was considerable hardship to several mining operations and communities in the West, and produced widespread complaint, not because of unwillingness of those affected to make sacrifices for the nation at war, but because of their conviction that it was both discriminatory and futile. They pointed out that most of the younger gold miners had already gone to war or to war industries, and that the older ones were domiciled near the gold mines and probably would not move except as a last resort. Their contention that the cost in terms of wreckage of valuable peacetime industrial assets and isolated communities outweighed the gains was more or less borne out by results in the following two months, as the number of gold miners that turned up for employment in essential mines was insignificant. Alaska's largest producer, Alaska Juneau, was permitted to continue its milling operations because the mill was to handle newly developed Alaskan chrome ores. Later, the WPB permitted several gold mines to carry on operations on a reduced scale, provided that they would not consume materials needed in the war

effort or employ other than "elderly or infirm men".

Many gold-mining operations were permitted to continue because their ores contained significant amounts of essential minerals, or because the ores were siliceous and needed in copper smelting. Some others, like Alaska Juneau and the Golden Cycle, were able to convert their mills in part to treatment of accessible ores of essential metals. The Golden Queen, on the Mohave Desert, was investigating nearby scheelite deposits with this in view. Several dragline dredges shipped their draglines to construction work on projects important to the war.

During the year the famous Carlton tunnel, driven at record-breaking speed to drain deeper levels in the Cripple Creek district, made connection with the Portland mine, deepest in the district. The deeper development in Cripple Creek mines, made possible by this tunnel, opened up considerable high-grade ore, indicating that the hopes of its sponsors would be realized.

MERCURY, MICA, AND TIN—The high price of mercury which prevailed throughout the year was stimulating to mercury output in all the producing areas of the country, principally California, Oregon, Nevada, Texas, Arkansas, Alaska, and Idaho. Production was considerably in excess of what had been hoped for, and made the country nearly self-sufficient with respect to a mineral which had been classed as in the front rank of strategic materials. Of particular interest was the discovery by the U. S. Bureau of Mines of an important mercury-antimony orebody in the Yellow Pine district of Idaho. This orebody was immediately developed by the Bradley Mining Co., of California. In December announcement was made of the abandonment of the Idaho-Almaden mine, an important Idaho producer.

One of the most pressing shortages was of plate mica, the principal supply of which has customarily been derived from India. No reasonable synthetic substitute for plate mica has yet been devised for insulation in several types of electrical apparatus, particularly where compactness is required, as in airplane parts. A determined effort has been and is being made to increase production in all domestic areas known to produce plate mica, particularly in North Carolina, South Dakota, and New Hampshire. By dint of extraordinary efforts requirements have been met, but every pound produced is in immediate demand. A similar shortage exists with respect to quartz crystals suitable for oscillators used in radio communication, the principal supply of which comes from Brazil.

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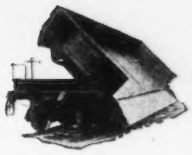

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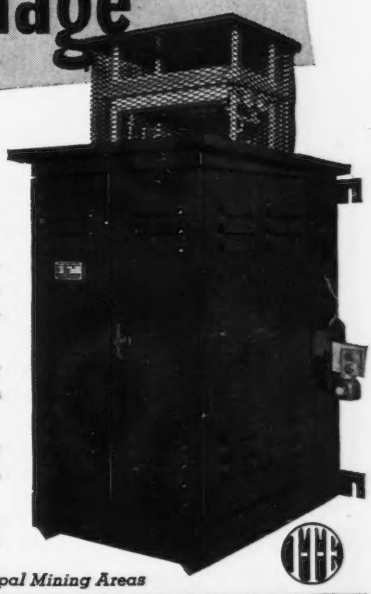
The aid to operating continuity is great. There are mines where sectionalizing has added as much as 10% to daily tonnage.



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Scrap Metals

(*Continued from page 77*)

taken by brass mills has been going into consumption. Rod brass turnings, for instance, have sold so poorly that some lots have been, by special permission, moved to ingot makers at below ceiling levels. Brass mills seemed so well stocked with especially desirable material—copper, zinc, and segregated scrap—they were reputedly averse to handling bulky turnings, perhaps with some contamination. Even turnings of gilding metal, being produced voluminously in the war effort, have been allowed to go to ingot makers when mills have turned offerings down. Large and increasing tonnages of gilding metal-clad steel shell scrap wait on the perfection of a process to remove the non-ferrous from the ferrous element. And only a small part of the large tonnages of aluminum bronze turnings has been finding an outlet, either for ingot making or for electrolytic production. Old nickel silver has been another scrap very difficult to sell, but one of the large brass mills is setting up a special plant to use this material. Electrolytic copper produced in 1941 by primary refineries from purchased scrap totaled 99,675 tons and another 9,693 tons of electrolytic grade (probably fire-refined) and 18,700 tons casting copper were produced. The 1942 total was probably not much larger, despite the tremendous consumption of refined copper. Brass ingot output in 1941 of 299,021 tons (gross weight) was widely outdistanced, as was the 152,637 tons secondary metal (gross weight) in castings. WPB put total secondary recovery of copper in 1942 at 700,000 tons, exclusive of mill scrap.

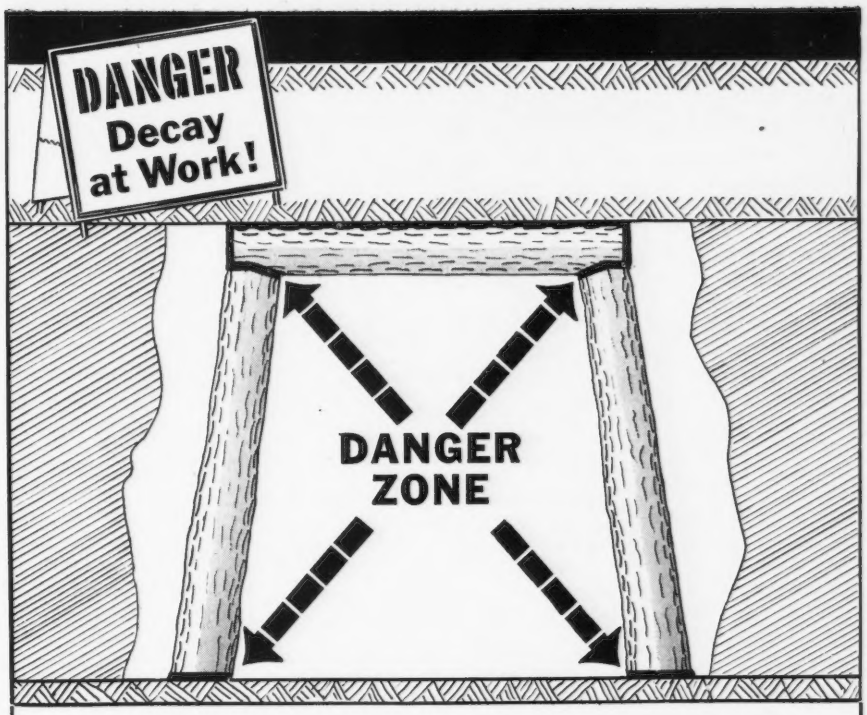
The large output of aluminum borings and turnings and residues naturally offered a problem to secondary smelters, and although the industry expended its facilities greatly a large amount of material was not worked up. Solid scrap was, of course, a different problem, being more readily segregated at war plants. Old sheet scrap was scarce all year, and even automobile crankcases and piston scrap supplies began to seem meager when specifications were liberalized to allow more and more low-grade alloy to be used directly and indirectly for war use. The tremendous steel output calls for large tonnages of aluminum as a deoxidizer. The output of secondary aluminum and alloy ingot in 1941 was 83,933 tons (gross weight). Necessarily, 1942 scored a big gain.

The loss of our sources of Straits tin naturally focused attention on secondary tin output. Because there was also a shortage of steel scrap and this scrap was also needed in the pre-

cipitation of copper, the collection and detinning of old cans became a major problem.

Beginning in June, last year, collections were started in four large cities and spread, under WPB directives, until in October even municipalities with 25,000 population started segregating old cans from household waste collections. The WPB program called for the handling by July, 1943, of 500,000 tons old cans, with a theoretical yield of 5,000 tons tin and 495,000 tons steel scrap. Plants in operation were rated as capable of handling 300,000 tons properly prepared cans, and seven new plants were to be built, but it seemed doubtful toward the end of the year whether more than three would go up. The public appeared to be slow to learn how to prepare the cans properly, and by November only 12,000 tons were handled by detinners in that month. In the meantime new tin plate scrap supplies for detinning had been curtailed. (The seven detinning plants operating in 1941 handled 5,963 long tons old tinplate and 341,075 tons new tinplate scrap and produced 5,089 tons pig tin.) The Tin Salvage Institute at Newark, N. J., was established as an MRC agent to reclaim the tin from old collapsible tubing, but a wholely minor amount of tin could be expected. Tin was also available in unused electrotype plates, and MRC agents were buying these up and the tin was being reclaimed by another agent. Other tin is available in drosses and the like, unused because conservation orders and plant conversions have severely curtailed the use of solder and babbitts, and undoubtedly some government arrangements will be made to recover the tin. Most of 1941's total secondary tin recovery was in and from brass and lead alloys, and the tonnages from purely tin-base alloys and residues are relatively limited. Tin scrap was one division of the market that had no specific ceiling prices set. The industry, with its great number of dealers doing pot smelting, is too complicated. Generally speaking, larger secondary white metal smelters were severely hit by the war and many of these establishments **shut down.**

The secondary lead and alloy industry was also depressed by war regulations. Conservation orders on lead and antimonial lead and restrictions on automobile manufacture and travel and on building generally put what secondary smelters regarded, in part, as an unnecessary handicap on their business because of the large stocks of refined lead available. In 1941, scrap and secondary lead had served as a substitute for the scarce and priority-rated metals. Only toward the end of 1942 was some relief from restrictions given, but the shortages of gasoline and rubber, curtailing travel even more drastically, loomed omi-



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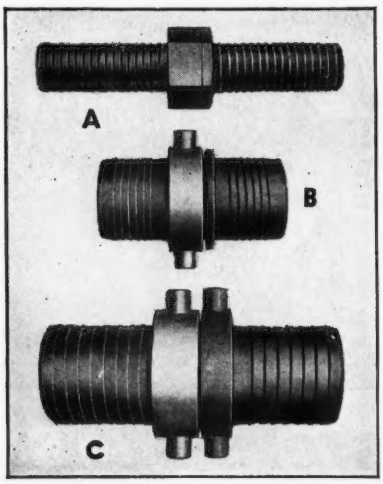

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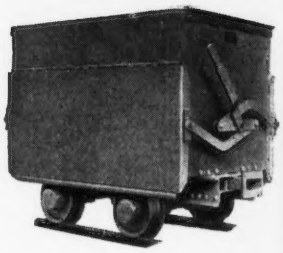
Scrap Metals

(*Continued from page* 157)

nously. Even some of the larger smelters of battery plates were out of the market for scrap, and for most of the year both soft and antimonial lead scrap sold under the ceiling levels set in June. Total recovery from scrap in 1941 totaled 397,416 tons, of which 380,280 tons was from old material. WPB estimated 1942 recovery as 10 percent under the latter figure, and 1943 recovery as probably 25 percent less.

Scrap zinc, which had shown sharply inflationary price tendencies in 1941, so that OPA in this field set its second ceiling schedule, was by sharp contrast a weak sister in the second half of 1942, prices sliding off about a half cent from ceilings amended in October, 1941. The substitution of 100 percent allocations on June 1 and the conservation orders beginning in September shut down sharply on the movement of remelt and the poorer grades of refined metal. A large part of this metal, as well as new scrap, had normally found its way into galvanizing, but galvanizers' operations were cut about 50 percent in 1942. Secondary die cast metal also suffered, until toward the end of the year, some outlet in aircraft processes was opened up. And, of course, brass mills, which had no use for Prime Western zinc, had none for secondary except that distilled up to the Intermediate grade, or perhaps Brass Special. Normally, most of the secondary recovery figures represent zinc recovered in the melting of brass or from zinc-base drosses, skimmings, ashes, and similar material; and only a limited amount is represented by solid scrap that can be remelted. The anomalous condition was, therefore, observed in the latter part of 1942, that while solid zinc, scrap and remelt seemed in larger supply than demand, larger secondaries using drosses and skimmings found supplies limited because, of poor galvanizing operations and because much of these galvanizers, drosses and skimmings were going into the production of zinc dust. It was therefore not surprising that zinc dust was put under complete allocation at the year-end, effective Jan. 1, 1943, and perhaps solid scrap will be rechanneled so as to go into the production of high grades of zinc needed by brass mills. Of 1941's secondary recovery, 143,236 tons was from or in copper alloys. Of 217,093 tons zinc-base scrap used, only 29,178 tons represented solids; the rest was in skimmings, ashes, drosses, flue dusts, and other residues. Probably 1942's recovery will be much greater from copper-base scrap; lower from zinc-base materials.



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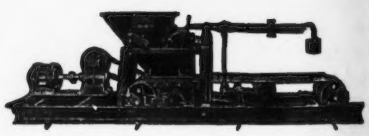

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